Petroleum Processing

INCLUDING PETROCHEMICAL SECTION APRIL, 1955

COKER TIP TOP — Scrubber vents on world's first Fluid coking unit—p. 501

NEED MORE OCTANES? — Rexforming gives you 100 + clear . . . p. 495

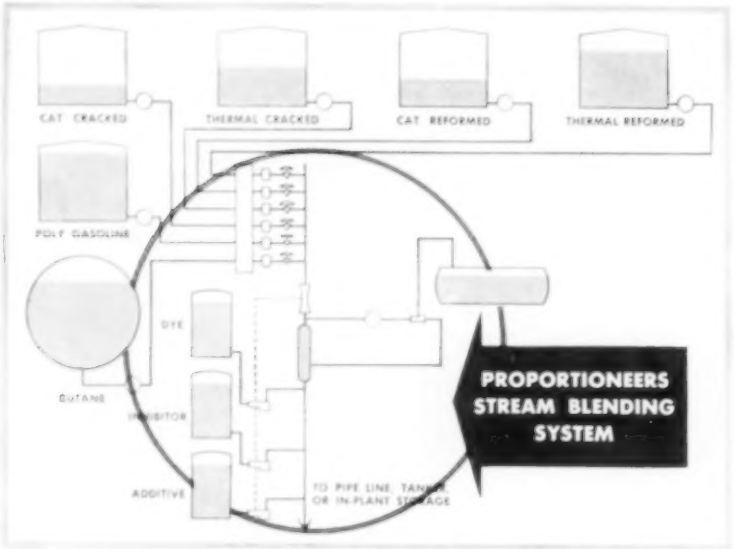
MAINTENANCE PAY-OFF — How Ethyl cuts costs 10% and more . . p. 530

CONTROL IMPORTS YOURSELF — Legislation can be dangerous . . p. 596

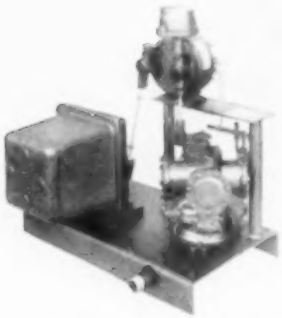
A McGRAW-HILL PUBLICATION

B-I-F METERS FEEDERS CONTROLS

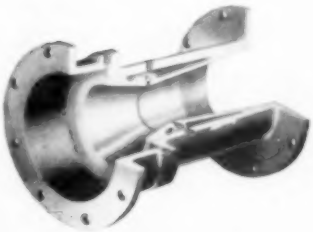
for the petroleum industry



Chlorine gas feeders.



Flow responsive additive blenders.



Differential producers for liquids and gases.

WHAT IS "OCTANE GIVE-AWAY" COSTING YOU?

If you have ever had to fill low-octane requirements with higher-octane blends, you've been caught in the "octane give-away" game. Or if you have found yourself with big gasoline inventories when you needed heating oils, or heating oils when you needed gasolines, you have again been trapped by inflexible methods of products movement.

The Proportioneers Stream Blending System provides maximum flexibility of refinery operation by permitting you to maintain inventories in base stocks . . . ready for stream blending to take advantage of specific seasonal market conditions. This Blending System also allows you to accumulate high-octane stocks in anticipation of equipment turnaround.

Proportioneers multiple component blenders automatically maintain preset formulations at all flow rates of finished product. They are now serving refineries in the United States and 16 foreign countries. Our experience in engineering, manufacture, and service of complete blending systems is at your disposal. Write Proportioneers, Inc., 447 Harris Ave., Providence 1, Rhode Island.

PROPORTIONEERS

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • OMEGA MACHINE CO. • BUILDERS-PROVIDENCE, INC.

B-I-F METERS FEEDERS CONTROLS

Were you shortchanged last month?

• Like getting your windshield cleaned when buying gasoline from a first-class service station operator . . . you naturally expect prompt and understanding service when ordering maintenance supplies for refinery or petrochemical plant operations . . . and you feel "shortchanged" if you don't get it.

"Oilwell" representatives in refinery equipment sales, fully understand your material problems and know what is needed to keep you "on stream." The practical experience which they have had in the application and use of refinery equipment qualifies them as "specialists" in this work—not mere "catalog" men.

Read this imposing list of services that assure you of full value with every order from "Oilwell."

Complete warehouse system—Well-stocked warehouses are conveniently located to serve the important refining centers. Inquiries are given prompt attention and deliveries are made quickly to meet your emergency requirements.

Lower inventory investments—You can cut your own warehouse stocks to a minimum, reduce obsolescence and get a wider selection of materials, sizes and brand names from "Oilwell's" complete inventories.

Experienced personnel—"Oilwell" refinery specialists having been trained in refining and petrochemical plants, understand your material and service problems and can give you the service you require.

Quality products—"Oilwell" stocks include the best known brand names in equipment and materials, designed and approved for refinery operations. When it comes from "Oilwell," you know it will meet your specifications.

92 years of experience—From almost the beginning of the petroleum industry, "Oilwell" has worked with the men engaged in drilling and production. Our goal is to extend the same prompt, dependable and complete service to those responsible for Refining and Petrochemical operations.

These famous products are sold by "Oilwell"

Bridgeport Brass	Taylor-Forge
Catawissa	Thermoid
Johns-Manville	Vogt
Lunkenheimer	Walworth
Manning, Maxwell & Moore	Watson-Stillman
National Tube	Wilson-Snyder
	Worcester

and many others

OIL WELL SUPPLY

DIVISION
UNITED STATES STEEL CORPORATION
Executive Offices—DALLAS, TEXAS
with Refinery Warehouses at

Beaumont, Texas · Garland, Texas · Houston, Texas
Borger, Texas · Los Angeles, California
Casper, Wyoming · Odessa, Texas
Charleston, W. Virginia · Ponca City, Oklahoma

USS

Branches Serving All Oil Fields

"OILWELL"

Trade-Mark

UNITED STATES STEEL

WIGGINS DOUBLE PONTOON FLOATING ROOFS

Safest Storage for Your "Liquid Assets"

Performance records prove that Wiggins Double Pontoon Floating Roofs soon pay for themselves in liquid conserved. Only Wiggins Double Pontoon Floating Roofs have every important feature for maximum conservation . . . safest operation . . . low-cost maintenance.

Triple Seal increases conservation savings and adds extra safety.

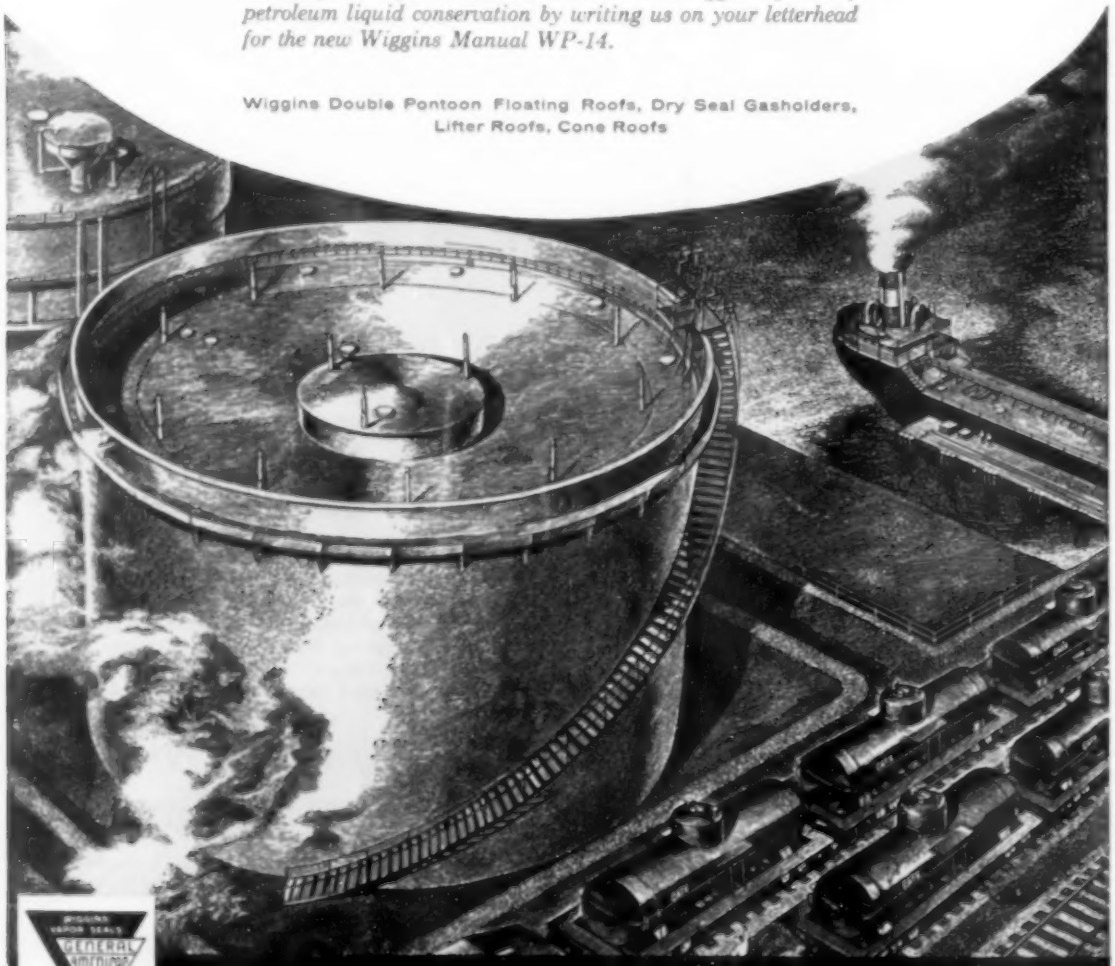
Multiple gas-tight pontoon compartments increase safety, strength and buoyancy.

Simplified design gives strength with minimum trussing, making inspection and maintenance easy.

Complete, clean drainage reduces corrosion problems.

Get the full story on the General American-Wiggins system of petroleum liquid conservation by writing us on your letterhead for the new Wiggins Manual WP-14.

Wiggins Double Pontoon Floating Roofs, Dry Seal Gasholders, Lifter Roofs, Cone Roofs



GENERAL AMERICAN TRANSPORTATION CORPORATION

135 SOUTH LA SALLE STREET · CHICAGO 90, ILLINOIS

Petroleum Processing

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels, lubricants and chemicals

April, 1955
Vol. 10, No. 4

Contents

FEATURE ARTICLES

Refining Section

Try Rexforming for 100-plus Octanes 495

A UOP process development aimed at the engine of tomorrow, by H. W. Grote, V. Haensel, and M. J. Sterba

What Does Big Union Mean? 499

A wages and members drive is certain, further mergers probable, but strategy is still unknown

Keep Those Pressure Vessels Safe 502

First of three articles on safe operation of unfired pressure vessels, by Walter Samans

Choosing Grease-Making Equipment 505

Some good advice that can help you turn out a uniform product more quickly, by O. L. Yarham

Are Cascade Controls For You? 511

Basic facts, some applications, and why they might suit your operations, by Harry J. Hartz

New Additive for Low-Temperature Sludging 516

Here's a new detergent du Pont researchers developed specially for stop-and-start auto driving

Technical Tips on Petroleum Processing 518

Refiners and panel talk out operating problems in this wire-recorded WPRA session, Part 2 of a series

Petrochemical Section

The Future for Synthetic Detergents 527

Oil company forecast shows they will take 75% of the total market by 1962

How Ethyl Cut Maintenance Costs 530

An investment of $4,000,000 is saving 10% to 12% on maintenance manpower

DEPARTMENTS

Publisher's Page 445
What's Happening 447
Tomorrow 451
Letters 454
Operating Trends 457
News in Views 529, 536
New Words 536
Plant Practices 539
Personals 545
Patents 549
Suppliers 553
Books 557
Meetings 561
Information Offered 563
Advertisers' Index 564
What's New 565
Editorials 596

A McGRAW-HILL PUBLICATION

Member of Associated Business Publications and Audit Bureau of Circulations

Petroleum Processing is published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), founder.

Publication Office: 330 West 42nd St., New York 36, N. Y.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cosby, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Director of Advertising; J. E. Blackburn, Jr., Vice-President and Circulation Director.

Subscriptions: Address correspondence to Petroleum Processing, Subscription Service, 330 West 42nd St., New York 36, N. Y. Subscription rates: domestic single copies 50c, United States and possessions and Canada, $1 per year, $2 for two years, $3 for three years; Latin American and all other countries, $5 per year, $8 for two years, $10 for three years.

Published prior to Sept. 1946 as the Technical Section of National Petroleum News, devoted to Refinery Management and Petroleum Chemical Technology, and including International Petroleum Technology. Entered as second class matter March 12, 1934 at the Post Office in New York, New York under the act of March 3, 1879. Printed in U.S.A.

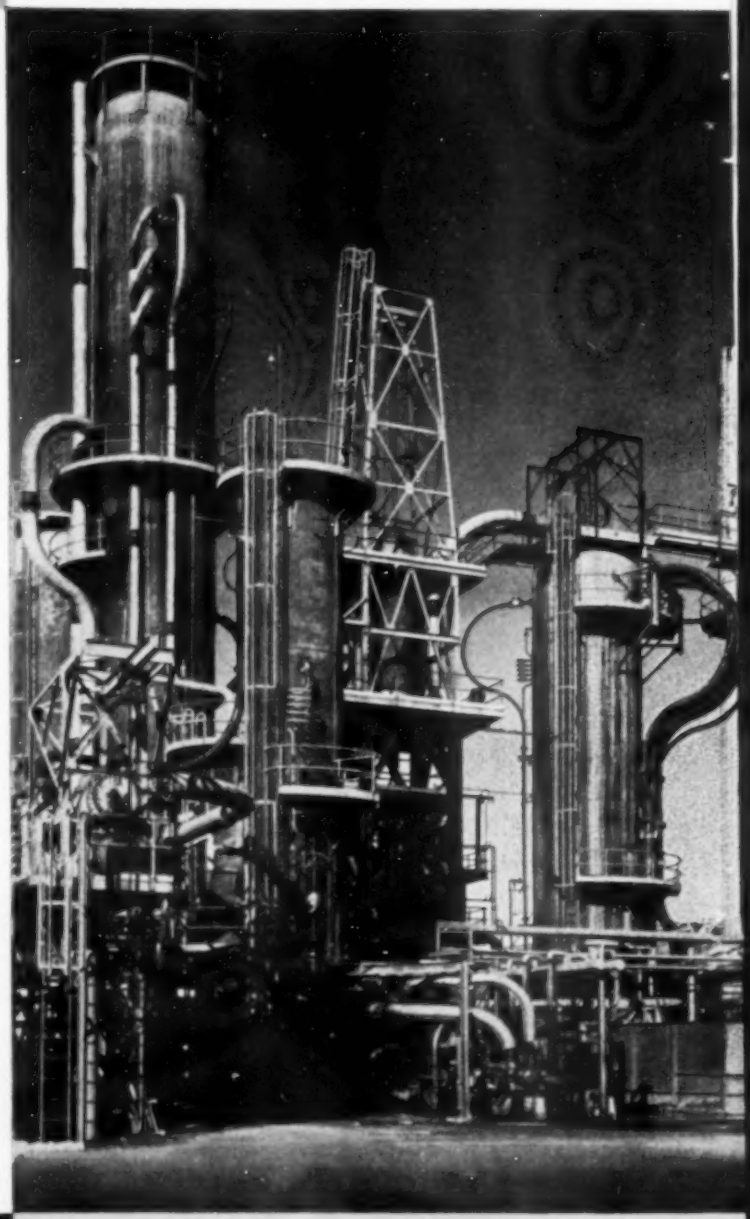
Copyright by McGraw-Hill Publishing Co., Inc. All rights reserved.

10 REASONS WHY

LEADING REFINERS RELY ON KONTOL FOR PROTECTION AGAINST CORROSION

1. Kontol protects against attack by organic and inorganic acids and brines which cause corrosion, hydrogen blistering and embrittlement.
2. Kontol effectively protects steel, nickel and stainless alloys of steel, monel, brass and admiralty metal.
3. Kontol offers detergent action as well as inhibitive properties. It also assures the advantages of operations with clean units and flow systems.
4. Kontol has no adverse effects on distilled product properties such as distillation end point, gum formation, anti-knock rating, ash, etc.
5. Compared with the replacement costs of the equipment it protects, the cost of Kontol protection is negligible.
6. Kontol is convenient and safe to handle, easy to apply. No gloves, masks, goggles, aprons or extraordinary safety precautions are necessary.
7. Kontol is available in many formulas, to meet varying requirements. It can be oil soluble; oil soluble and water dispersible; water soluble and oil insoluble.
8. Kontol, in the appropriate formula, is miscible in all proportions with aqueous alkaline agents and can be injected through the same system.
9. The Tretolite commercial testing staff will carry on tests to determine the rate of corrosion in your refinery, at no cost to you.
10. Kontol has been proved to provide protection against corrosion in

CAT CRACKER FRACTIONATORS
CRUDE STILLS
DEPROPANIZERS
DEBUTANIZERS
DEPENTANIZERS
GAS RECOVERY SYSTEMS
ABSORBERS
STABILIZERS
PLATFORMERS
REFORMERS
DESULFURIZATION SYSTEMS
VACUUM TOWERS
ALKYLATION PLANTS
COKING SYSTEMS
DEWAXING SYSTEMS
ALKANOLAMINE SWEETNERS



TRETOLITE COMPANY
KONTOL
SAINT LOUIS - LOS ANGELES

Chemicals and Services for the Petroleum Industry

DESALTING • CORROSION INHIBITING • WATER DE-OILING
DEMULSIFYING • SCALE PREVENTION • ASPHALT ADDITIVES

If you have a corrosion or fouling problem, get in touch with the Tretolite refinery service engineer in your area or write to

TRETOLITE COMPANY
A DIVISION OF PETROLITE CORPORATION

369 Marshall Avenue, St. Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California

A McGRAW-HILL PUBLICATION

Editorial & Business Offices
330 West 42nd St., New York 36, N.Y.

Harry L. Waddell, Publisher

Editorial Staff

William F. Bland, Editor

William C. Uhl, Managing Editor

Virgil B. Guthrie, Associate Editor

Robert L. Davidson, Assistant Editor

William A. Caperell, Jr., Art Director

Stuart D. Boynton, Editorial Assistant

Jane L. Witzig, Editorial Assistant

D. P. Thornton, Jr., Southwestern Editor
W724 Prudential Bldg., Houston 25

Richard R. Elwell, West Coast Editor
1111 Wilshire Blvd., Los Angeles 17

Andrew R. Patla, Washington Editor
1188 Nat'l. Press Bldg., Washington 4

Peter J. Gaylor, Patent Reviewer

Business Staff

K. W. McKinley, Advertising Sales Mgr.

John E. Thompson, Production Mgr.

Regional Sales Representatives

NEW YORK 36, N. Y.
Fred R. Emerson, 330 West 42nd St.
Walter W. Patten, 330 West 42nd St.

PHILADELPHIA 3, PA.
C. J. Jefferis, 17th and Sansom Sts.

ATLANTA 3, GA.
S. T. Henry, 801 Rhodes-Haverty Bldg.

CLEVELAND 15, OHIO
William R. Freeman, 1510 Hanna Bldg.

CHICAGO 11, ILL.
Robert W. Bruley, 520 N. Michigan Ave.

HOUSTON 25, TEXAS
George Reid, W724 Prudential Bldg.

DALLAS 1, TEXAS
J. H. Cash, First Nat'l Bank Building

SAN FRANCISCO 4, CALIF.
T. Evans Wyckoff, 68 Post St.

LOS ANGELES 17, CALIF.
William C. Woolston, 1111 Wilshire Blvd.

For Married Men Only

DOES your wife nag you? Does she complain about the business magazines (like PETROLEUM PROCESSING) which you get at home every month? Does she tell you to quit cluttering up the house with them? Does she resent the time you spend "sticking your nose into them every night of the week"?

We've found the answer to your problems.

Just point out to her that she gets and reads her own business magazines at home—so why shouldn't you? She'll probably deny vehemently that she ever cracks the cover on any "old" business magazine—and that's your clue to pick up the latest copies of *Vogue* and *Good Housekeeping*, thrust them under her uptilted nose, and ask her what she thinks they are if not business magazines.

We got this idea for the male-defense from the magazine *Electrical West*, which further suggests that you point out to your wife that her business is (a) keeping herself attractive so she can keep you, and (b) maintaining the kind of home you both want and which will make the correct impression on your friends. So she reads her business magazines to learn about the latest hair styles and clothes fashions, and to get ideas on interior decorating and home management. And she reads the ads that tell about the new cosmetics and clothes aimed at making her more attractive and alluring, and the new appliances and gadgets which ease the homemaking job.

She'll probably be quite convinced at this point—but to make sure of it, you'd better follow up with a little pitch on why you read your business magazines.

Basically, you read them because of the competition of keeping constantly abreast of your job, and the pressures of a complex, dynamic, fast-moving industry which force you to keep up-to-date. Men who hold key positions in industry or who are striving to win such jobs get ahead and keep ahead because they possess know-how—know-how which can't be found in books because it develops too fast for books to keep up with it—know-how which can be picked up for the most part only from active, informed, and constantly informing business magazines which distribute new knowledge as fast as it sprouts.

There's something new to learn every month—almost every day—and the technical man who wants to hold his own, to say nothing of moving ahead, must depend largely on his business magazines to help him with that learning—just as your wife depends on her own business magazines.

William F. Bland

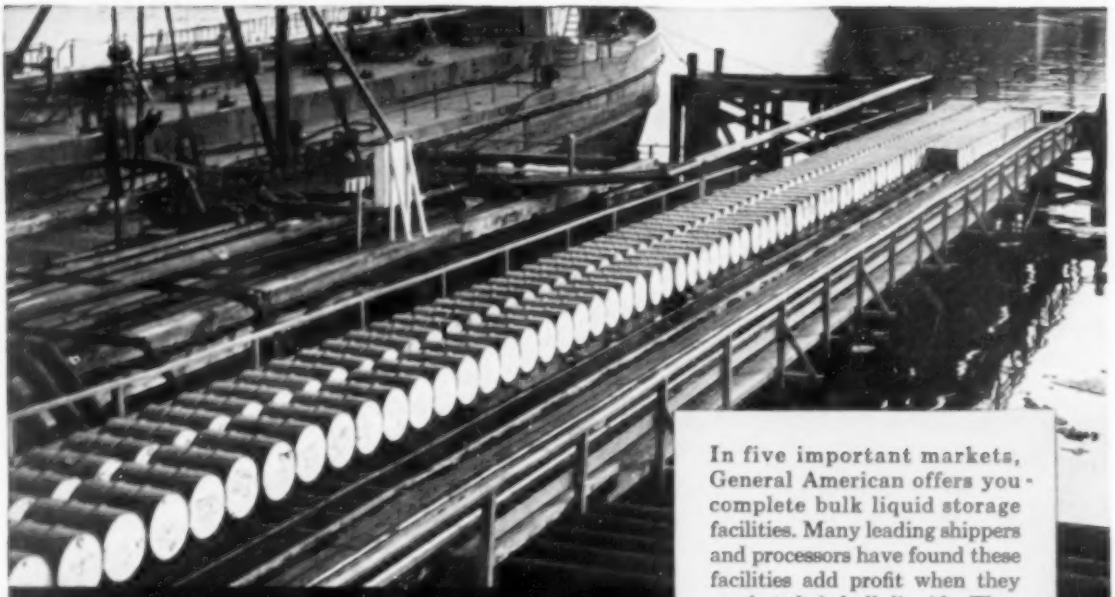
Editor

Other McGraw-Hill Petroleum Publications

National Petroleum News
The monthly oil marketing magazine, covering news, prices, transportation, storage, merchandising.

Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago and Houston.

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago and Houston.



Store and Distribute
your bulk liquids
as the market demands—
with no capital investment

GENERAL AMERICAN TANK STORAGE TERMINALS
a division of GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South LaSalle Street · Chicago 90, Illinois

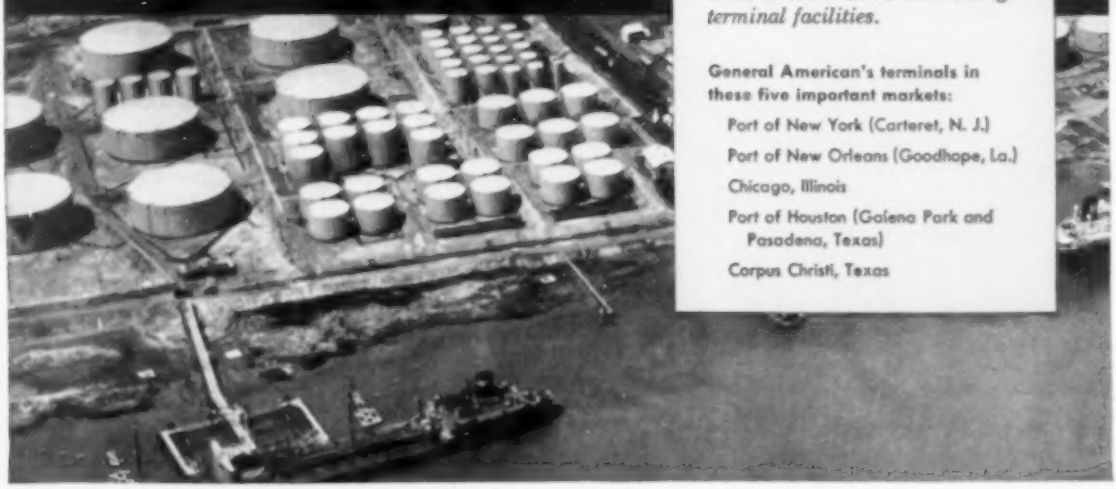
In five important markets, General American offers you complete bulk liquid storage facilities. Many leading shippers and processors have found these facilities add profit when they market their bulk liquids. They can maintain inventories of their products for distribution at the right time and place; gain economies of shipping in bulk; and *conserve* capital.

Modern storage tanks . . . for anything that flows through a pipeline . . . are yours to use. You can be sure of privacy. Carefully guarded manifolds, pipes and pumps to protect your product against contamination. Barrelling, drumming, canning and blending services at New York, New Orleans and Chicago. All this, without capital investment on your part!

Ask about the marketing advantages you receive from leasing General American's tank storage terminal facilities.

General American's terminals in these five important markets:

Port of New York (Carteret, N. J.)
Port of New Orleans (Goodhope, La.)
Chicago, Illinois
Port of Houston (Galena Park and Pasadena, Texas)
Corpus Christi, Texas



What's Happening

in Refining

. . . **Two new processes aimed at 100-plus octanes** were offered refiners late last month, both said to be capable of producing good yields.

In a variation of optional process schemes, Houdry's Iso-Plus Reforming is an integrated combination of Houdriforming with aromatics extraction or with thermal reforming. (Watch next issue for details.)

The second is Universal Oil Products Co.'s new Rexforming, also a combination operation of catalytic reforming with extraction, plus a recycle of low octane naphtha (see pp. 495-498, this issue).

. . . **Standard Oil Co. (Indiana)** has awarded C. F. Braun & Co. prime contract on construction of a new 55,000 b/d crude still at Whiting, with completion scheduled for January, 1956.

. . . **Shell Oil Co. of Canada, Ltd.,** will build a 3300 b/d UOP Platformer at Vancouver, B. C., at an estimated cost of $1,500,000, with completion at the end of 1955. Procon (Canada), Ltd., has contract.

. . . **Tide Water Associated Oil Co.** will build its $100,000,000 new refinery on a 4200-acre site on the west bank of the Delaware River, 15 miles south of Wilmington. Equipment will include the largest crude still ever built, 130,000 b/d; the largest catalytic cracker built, a 102,000 b/d Orthoflow Fluid unit; and a 42,000 b/d Fluid coker, also the largest ever built. Other units include catalytic hydro-desulfurization, polymerization, alkylation, and sulfur recovery.

The new Fluid coker, second to be built (see this month's cover picture), will produce fluid coke which in turn will be used as plant fuel.

. . . **American Oil Co.** has awarded M. W. Kellogg Co. contract for construction of a 35,000 b/d crude unit and a 30,000 b/d Fluid cat cracker with integral polymerization unit, for its new Yorktown, Va., refinery. Major contracts still to be let during next few months include catalytic reformer, coker, gas oil desulfurization and buildings and tanks.

. . . **Pure Oil Co.'s** planned capital expenditures in 1955 of $41,000,000 will include new catalytic reforming units at Lemont, Ill., and Smiths Bluff, Tex.

. . . **Gulf Oil Corp.** will build a 100,000 b/d crude still, a 50,000 b/d Fluid cat cracker, and auxiliary units at Port Arthur, Texas, and has received fast tax write-off approval on a portion of the estimated total cost of $29,044,800.

. . . **Farmington Funding Corp.,** Colorado Springs investment firm, has purchased 85% interest in Wisconsin Oil Refining Co., and plans immediate expansion of Sheboygan, Wisc., 5000 b/d refinery. Project will be in road oil and asphalt, with Koch Engrg. Co. to build a 2500 b/d vacuum still.

Farmington also has acquired 30% interest in Corpus Christi (Texas) Refining Co., with no expansion in immediate plans for the 8000 b/d plant.

. . . **Standard Oil Co. of Texas** has obtained fast tax write-off approval on a 4300 b/d catalytic reformer, and a feed preparation unit at El Paso, Texas, at an estimated total cost of $2,700,000.

. . . **The Texas Co.** will build a new 4800 b/d platinum type catalytic reformer at Casper, Wyo., with completion scheduled for early in 1956.

. . . **Standard Oil Co. (Indiana)** will add a 6000 b/d Ultraforming unit and other new facilities at its new Mandan, N. D., refinery, with completion scheduled for late spring, 1956.

. . . **Houdry Process Corp.** is offering a new catalytic cracking process for license which is said to give high yields of high octane motor gasoline and domestic furnace oil, total conversion of heavy residue, and eliminate all heavy residual oil. Named Houdresid, the process has been in successful commercial operation for one year at Sun Oil Co.'s Sarnia, Ont., refinery, on an existing Houdriflow unit.

. . . **Thunderbird Corp.** plans a 16,500 b/d refinery in the Florence-Coolidge, Ariz., area, at a cost of $30,000,000, with completion set for mid-1956, with general contract awarded to Ebasco Services, Inc. Plans are to tap a spur on the announced $30,000,000 pipeline between El Paso, Texas, and Watson, Calif., to be built by Southern Pacific Pipelines. Start of refinery construction depends on a commitment from Southern Pacific, who state line will not carry crude oil, but refined products only.

in Petrochemicals

. . . **Standard Oil Co. of California** plans a $16,000,000 program in fertilizer manufacturing, with construction to start immediately. An ammonia-(and nitric acid)-from-byproduct hydrogen plant will be built at Richmond. Additionally, California Spray-Chemical Corp., a Standard subsidiary, will build a plant to convert Standard's output into fertilizers. Planned capacity of combined facilities is 300 tons/day of ammonia. Completion is expected in mid-1956.

. . . **Northwest Nitro-Chemicals, Ltd.,** a new Canadian firm, plans a nitrogen and phosphate chemicals fertilizer plant in southern Alberta, operating on natural gas from the Etzikom Reserve, with completion scheduled for late-1956.

Northwest has been organized by Commercial Solvents Corp. (which will operate the venture), New British Dominion Oil Co., Ltd., Ford, Bacon & Davis, Inc. (prime contractor), and Frank McMahon of Alberta.

. . . **Canadian Hydrocarbons, Ltd.,** another new company, also plans a nitrogenous fertilizer plant in the Winnipeg area. Total investment for this and the Northwest Nitro-Chemicals' venture is said to be $40,000,000.

. . . **Nitrogen fertilizers-from-crude oil** is reported a new process to be used by Mekog, a Netherlands firm, with plans for a new plant at Velsen-Ymuiden, with estimated annual production of 130,000 tons.

. . . **B. F. Goodrich Co.** will spend over $25,000,000 in 1955 for expansion and improvement, with much of it going into modernization of synthetic rubber manufacture, says W. S. Richardson, president.

. . . **Koppers Co., Inc.,** and **Firestone Tire & Rubber Co.** along with Brazilian interests have formed a new company, Companhia Braziliera de Estireno, which will build and operate a 10,000,000 lb./yr. styrene monomer plant at Cubatao, using ethylene from adjacent government refinery, and imported benzene.

. . . **Utah Construction Co.** will build a petrochemical plant in conjunction with a steam-electric plant in the San Juan Basin, New Mexico. No further details were revealed as to products or completion date anticipated.

. . . **Sale of synthetic rubber plants became final** March 26 when neither House nor Congress disapproved the disposal program (see Feb. issue, pp. 375-381). Some last minute opposition had developed over questions posed by "foreign ownership" of Shell Chemical, who bid on three West Coast plants as an integrated unit, and controversy over Shell's bid. The transfer to private industry is expected shortly.

in Foreign Operations

. . . **Gewerkschaft Erdoel-Raffinerie Emsland** has awarded general engineering and construction contract for 3500 b/d Houdriformer at Lingen, Germany, to Lummus Co., Ltd., with completion scheduled for end of this year.

. . . **Petroleo Brasileiro S.A.** has awarded Southwestern Engrg. Co., Los Angeles, a contract to construct a 3500 b/d asphalt plant at Cubatao, Brazil, with completion scheduled for November.

. . . **Porto Marghera** refinery, Venice, jointly-owned by British Petroleum Co. and Azienda Generale Italiana Petroli, will install a 1750 b/d Platformer.

. . . **Finns have rejected Soviet offer** to build a refinery for government-controlled Neste Corp., for "technical reasons."

. . . **Foreign refineries in early planning stage** as of now include: Idemitsu Kosan Co. of Tokyo, a plant at Tokuyama; Hydrocarbon Mineraloel, a German firm, with Greek government approval to build at Aspropyrgos; and a refinery at Makarska, Yugoslavia.

. . . **Shell Chemicals** has offered to buy Petrochemicals, Ltd., British firm, for $14,000,000. Chairman of Petrochemicals has recommended acceptance. Company has been in difficulty for some time, operating on a $26,000,000 loan from British equivalent of U. S. Reconstruction Finance Corp.

in Markets and Prices

. . . **Concern increased in market circles** over the jump in gasoline inventories since first of year, with stocks hitting all-time peak of 183,400,000 bbl. at mid-March, 5,700,000 bbl. higher than year ago. Observers generally recalled sharp dip in motor fuel prices during last summer's peak buying period.

Continental Oil president L. F. McCollum warned: "failure to achieve proper inventory levels could only result in a repetition of last year's troubles."

. . . **On other hand, inventories were off** sharply on both distillates and heavy fuels. Trade predictions for the latter were for a continued tight market. The high level of industrial activity (steel mills operating above 90% of capacity) is expected to prevent any easing of the east-of-California residual situation.

California is only area of surplus. And if buyers far and wide continue to show interest, some observers feel that too can change. In addition to more resid booked for East Coast shipment, a 20,000-ton cargo of California heavy fuel has been sold for April shipment to Hamburg, Germany.

. . . **Prices generally for refined products** were unchanged. But, there was another 0.5¢/gal. dip in LPG and natural gasoline prices. Group 3 contract prices of some producers for propane were down to 2.5¢/gal. Natural gasoline, Grade 26-70, was quoted at 4.5¢, Group 3, and 4¢, Breckenridge.

Looking Ahead

. . . **Watch Husky Oil Co. for petrochemical activities.** C. C. Crawford, previously president of his own Bartlesville chemical firm and before that with Phillips, has joined Husky to "conduct studies in the field of petrochemicals."

. . . **Another approach to cutting air pollution:** In New York City, Surface Transportation Co. is testing new Diesel fuel blend for buses to reduce exhaust smoke. Kerosine content of the fuel has been upped from 40 to 60%—at an extra cost of ½¢ per gal.

. . . **Sinclair Research Laboratories, Inc.,** have a new process for recovering oil from shale by controlled underground combustion, essentially retorting the shale oil in situ and pumping the oil to the surface as in conventional crude oil production. Work is continuing at its research facility near Rifle, Colo.

LUMMUS

THE LUMMUS COMPANY, 385 MADISON AVENUE, NEW YORK 17, N. Y.

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

SUNTIDE REFINING COMPANY

REFINING PETROLEUM SUNTIDE MARKETING PRODUCTS

P. O. BOX 888
CORPUS CHRISTI, TEXAS

F. L. MARTIN
PRESIDENT

November 3, 1954

Mr. C. A. Barrere
Vice President
The Lummus Company
2707 Weslayan Road
Houston, Texas

Dear Mr. Barrere:

It is with a great deal of satisfaction we advise you and The Lummus Company of your outstanding performance and the remarkable record you achieved in the construction of our refinery here at Corpus Christi. The contract with your company was signed on February 6, 1952; groundbreaking ceremonies were held March 12, 1952, and you completed the refinery in eighteen months under the most adverse conditions and scarcity of materials. The expediting of the materials and the know-how of engineering and construction methods are the two prime factors in this record breaking completion.

In starting up this plant, the topping and vacuum, fluid catalytic cracking, gas concentration, polymerization, and alkylation units each were staffed with completely new personnel. Your operators started up each of these units, and each and every unit was accepted after a few days' performance test. In fact, the whole plant was accepted much sooner than would ordinarily be the case under these circumstances.

We are very happy with all phases of the plant. As a matter of fact, it has operated at a greater capacity than originally planned. I am pleased to advise that in all of my refining experience, I have never witnessed a more satisfactory installation, and all of us here at Suntide are very proud of our refinery's performance as well as its appearance.

We would appreciate your extending our sincere compliments for a job well done to all members of your organization who had part in the building of Suntide.

Yours very truly,

FLM/b...

NOW! An Entirely New Method For Sizing Controls!

BS&B's New, Exclusive Method Takes Both The GUESS And The WORK Out Of Controls Sizing For Liquid, Steam And Gas Applications!

Today's modern and complex processing systems require accurate control valve sizing. No one has recognized this fact more than BS&B.

Therefore, as a service to industry, BS&B set out to develop a new, simple, more accurate method of sizing controls. Here it is in the new BS&B Controls Sizing Manual.

This new, exclusive method uses two new "tools" to make sizing more accurate—the SIZE-O-GRAPH to determine what the valve MUST do and Cv RATINGS to determine what the valve WILL do.

These "tools" are based upon thousands of hydraulic flow tests performed on all sizes and types of BS&B Controls in the industry's largest and most modern flow testing laboratory. Results are proven by correlation with *actual* gas and steam flow tests.

If you'd like a copy of this new manual, write to . . .

BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-D4
7500 East 12th Street, Kansas City 26, Missouri

(To obtain more data on advertised products see page 564)

Higher Car Temperatures Seen as Challenge to Lubricant Designers

THE current era of accelerated mechanical changes in passenger car design is creating a demand for new types of lubricants as well as fuels. Most of the emphasis in public discussions has been on the fuels. Technologists with The Texas Co., however, have recently listed some of the car improvements, such as automatic transmissions, hydraulic valve lifters and power steering, together with their specialized lubrication needs.[1] They have also emphasized the trend to higher operating temperatures in cars, not only in the engine but also in other points in which oil suppliers are interested, as increasing the severity of the lubrication requirements.

The Texas Co., along with other large oil companies, for years has followed the practice of securing each year new cars of different makes and models and testing them in performance to observe the effect of the mechanical modifications on fuel and lubricant requirements. This information over the years has developed valuable data on the trend in fuel and lubricant needs.

Temperatures at various key points are taken as an indication of operational severity. In the company's present program temperatures are measured at 18 locations in the fuel, coolant, lubricating oil, air induction and exhaust systems. The report notes that the average oil sump temperature during full throttle operation of the new cars has increased from an average of 225 to over 250° F. in the postwar models and that the maximum increase in individual cars has been from around 240 to nearly 300° F.

"As temperatures in the crankcase increase," it is stated, "higher viscosity index oils with more oxidation inhibitor are required. . . . Greater engine output for a given engine size means that greater heat losses must be dissipated by the crankcase oil. Since only minor differences may be noted in crankcase design, it is reasonable to expect the oil temperatures to increase when dissipating the greater heat losses of the newer engines."

The trend toward higher automatic transmission temperatures over a greater part of their operating range may present a future problem for the oils in this use, it is brought out. The company reported there has been at least one new car per year in its test work which did not reach an equilibrium temperature under 350° F. at any test speed from 20 through 70 miles per hour.

"During full throttle operations since 1948" it was stated, "it has not been feasible to allow automatic transmissions to reach equilibrium temperatures at all speeds because dangerously high levels may be attained. . . . Fortunately, such temperatures are not likely to be encountered by the average motorist since he seldom operates his car at full throttle for any appreciable period of time at the lower critical speeds."

It would seem logical, the report states, to expect differential temperatures to increase in later years due to the higher power and torque levels also handled by them, but this has not been the case. "After 1950, overheating of automatic transmissions precluded the operation of a large number of cars until rear axle equilibrium was attained. . . . Although it cannot be shown, it seems likely that at least a small increase in rear axle operating temperatures has occurred."

The trend in passenger car lubricant requirements is only one example of a current development taking place on a wide scale. In all types of equipment for industrial use, higher temperatures, pressures and operating speeds add to the lubrication severity and call for new types of oil, and greater use of chemical additives for specialized jobs. —V. B. G.

[1] "Trends in the Design of Passenger Cars Affecting Fuels and Lubricants"; E. M. Johnson and C. W. Mortensen, Products Application Dept., Beacon Laboratories, The Texas Co., Beacon, N.Y.; before API Lubrication Committee Meeting, Detroit, Feb. 17, 1955.

Biggest Advances Still Ahead in Process Control Instrumentation

THERE is certainly no end in sight for the potential advances in the field of instrumentation, according to J. J. Grebe of Dow Chemical Co., who visualizes that in less than 10 years instrument shops may number atomic piles among their maintenance tools.[1] Such piles would be used to produce short-lived isotopes as process tracers and detectors for process measurements as well as for research.

Plants already have such devices as the mass, ultraviolet, and infrared spectrometers, and are using them to indicate what is going on in the process as well as for direct control in some cases. The next step in the instrumentation field is the application of a "digitizer," already in development, which will transfer the spectrometer indication to digital form for the records, simultaneously with operation of the spectrometer. This, in turn, will eventually be hitched to a digital computer to make the necessary calculations and then set the appropriate control devices in a process operation.

As an illustration of the potential time-saving involved, the digital computer will do in two minutes work that requires three hours on a desk calculator, Grebe pointed out. The analyst takes 30 minutes to read mass spectrometer charts and prepare data for calculation: the digitizer prepares the data as the spectrometer works. Thus, we have an elapsed time of two minutes from analysis to decision and reaction by machines, as compared to nearly four man-hours for the same job now.

Probably the greatest advances in instrumentation will come through the applications of the principles of resonance, Grebe says. These will include the use of radioactive isotopes for everyday plant operation and control. From the resultant indications with these materials, men and computers can deduce most process conditions—including concentration (analysis), level, rate of acceleration of particles or the kinetics of a

chemical reaction, depth, height, velocity and identification of the end of a batch reaction. The addition of computers could—as people learn to trust them—modernize long range production control.

The final application which can be conceived for instrumentation is in the ramifications of human existence and mental processes, which are in fact covered by the Second Law of Thermodynamics—all systems tend to approach an equilibrium. As we learn to express conditions more concretely, men will learn to devise methods of measurement, whence the possibilities of control will follow. —D. P. T.

(1) "New Instrumentation for Research," by J. J. Grebe, director of nuclear research and development, Dow Chemical Co., presented at the Short Course on Instrumentation for the Process Industries, A & M College, College Station, Texas, January 26, 1955.

Will Coal Distillation Process Steal Petroleum Markets?

COAL has been waging a losing battle with petroleum as a source of fuel and chemical raw materials during the past decade.

Recent evidence of coal's comeback fight was revealed in the announcement by Cotarco, Inc., of plans to build a $11,500,000 low temperature coal carbonization plant in Colorado.[1]

Cotarco, a subsidiary of Resources International Corp. of New York City, has six possible Colorado sites under study for the plant, according to H. H. Haas, executive vice-president at Denver headquarters.

Processing 8,520 tons of coal daily, Cotarco anticipates yields of 5,930 tons of char product; 15 million cu. ft. of 645 BTU fuel gas; 71,000 gals. acid oils; 6,400 gals. light oil; 57,300 gals. creosote oil; 72,000 gals. pitch; and 67 tons of sulfur.

Inventors of the "Low Temperature Coal Distillation Process" are Dr. F. E. Poindexter—retired former head of St. Louis University's physics department—and Frank W. Lowe, president of Lowe & Co., St. Louis, Mo.

The Poindexter-Lowe process[2] is based on a coal carbonization process developed in the 1920's. In this process, pulverized coal was raked down an inclined plate in a heated atmosphere to distill liquid materials from the coal.

Poor results from the old process were mainly due to the low heat conductivity of coal—approximately 0.064 BTU/(hr.) (ft.) (°F.).

Poindexter and Lowe feel that they have overcome coal's poor conductivity by using a mechanical stirring device resembling old-time ice cream mixer paddles in a horizontal position. These blades turn through the bed of coal 20,000 times per hour. This stirring constantly presents new coal surfaces to the heated atmosphere, increasing heat transfer to the coal 141-fold over the non-stirred state.

In addition to the value of the oils, fuel gas, etc., the char product from the distillation is valuable for use as smokeless fuel in producer gas synthesis.

Whether this process will go into actual production or not, and whether or not $11,500,000 is adequate for the proposed production rates, are matters of some controversy. However, Cotarco's announcement is another step in coal's attempt to regain part of their markets lost to the petroleum industry. —R. L. D.

[1] Platt's OILGRAM News Service—New York Edition, March 2, 1955, page 3.
[2] United States Patents 2,615,834 and 2,697,068.

Proposed Vapor Pressure Change Can Mean Shift in Butane Uses

THE door will be opened to an expanded market for light hydrocarbons next summer if a proposal soon to be voted upon by Committee D-2 on Petroleum Products and Lubricants receives a favorable vote, which now seems likely.

American Society for Testing Materials' D-2 group is being asked to accept a proposal to boost the summer volatility specification of motor gasolines by 0.5 lb., to 10 lb., Reid vapor pressure, in all states except Arizona, California, Colorado, New Mexico, Nevada, and Utah. Evidence was laid before the committee that automotive engines can accept such a fuel with reasonable freedom from vapor locking. Results of the ballot will be announced in June.

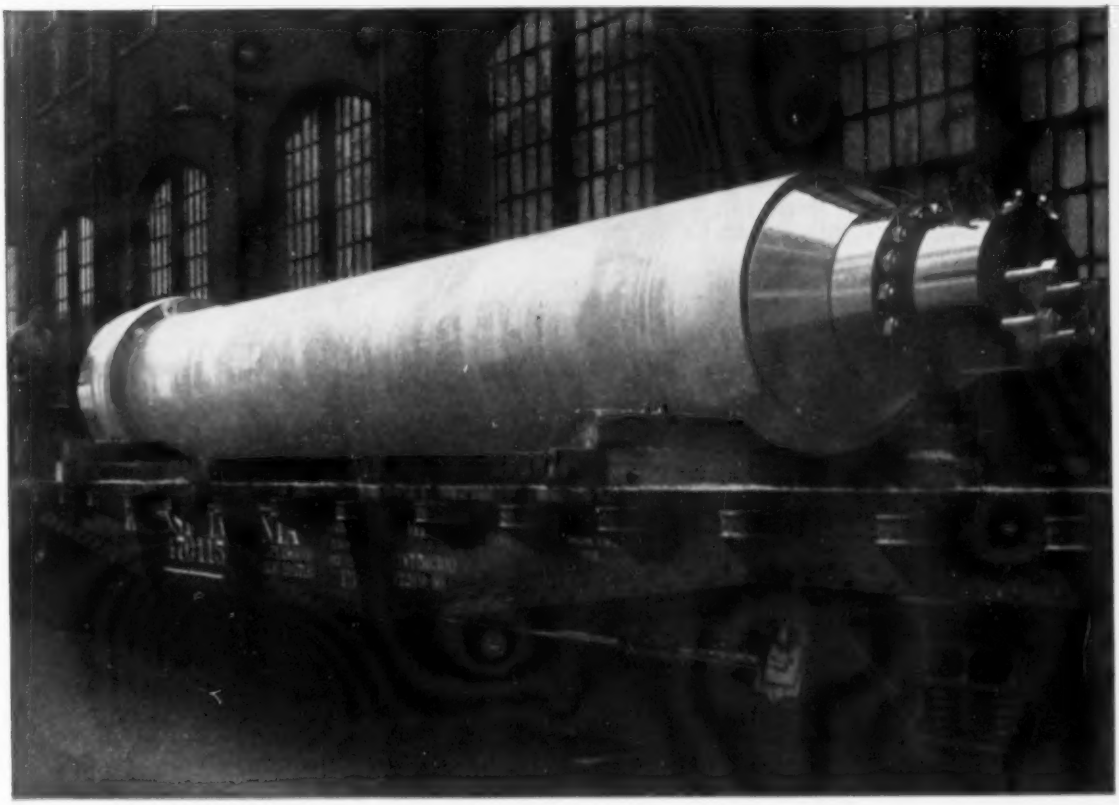
This jump in RVP will permit, for instance, blending at least 1% more butane than now can be done. The average will probably exceed that figure. Actually, the exact amount will depend upon the nature of the base stock used by each individual refiner, the exact pattern of the distillation curve for the finished product desired, and other characteristics.

This might mean 5,000,000 to 6,000,000 bbls. of additional butane, as a conservative estimate, which could be used in summer gasoline. This is butane which today must find some other home or be used in refinery fuel.

Next hurdle will be the job of persuading some states to liberalize their vapor pressure specifications. This probably cannot be done in time to permit much advantage to appear in 1955, although it could be done in time to permit maximum realization in 1956. It has been suggested that perhaps the thing to do is to persuade the various state regulatory bodies to tie in their specifications to those of ASTM. Such changes then would not require specific authorization every time a desirable change comes along.

The argument might be most convincingly based upon the fact that ASTM doesn't sell gasoline and its position in such matters is an unbiased one, taken only after deliberate and careful scientific evaluation of pertinent data by unquestioned experts. To "buy the brains" represented in ASTM's membership would be impractical—even for a state government—but the state is entitled to use the fruits of their investigations at no cost.

In any event, favorable action by the ASTM is not only important from the standpoint of conserving natural resources, but it will be financially advantageous both to refiners and to natural gasoline manufacturers. —D.P.T.



Extra STRENGTH ... *Added* SAFETY ... *Sealed* for SERVICE

MIDVALE FORGED PRESSURE VESSELS

Product-Converter
Body Diameter-55"
Inside Diameter-40"
Ring Diameter-68 1/4"
Overall Length-37'—2-15/16"
Operating Pressure-5,625 P.S.I.
Yield Strength-50,000 P.S.I.
Shipping Weight-144,240 lbs.

From the time this converter was on the drawing boards at Midvale until it was ready to roll on this flatcar strength and service was the keynote. Veteran steel makers melted the right alloy steel. Skilled hands forged toughness into it.

This converter is not unusual for Midvale—not the largest, not the smallest we make. A 268,000 pound octagonal ingot was forged and machined to an overall length of more than 37 feet with a body diameter of 55 inches. Hydrostatically tested at 8,450 psi. for working pressures of 5,625 psi. . . . yield strength of 50,000 pounds.

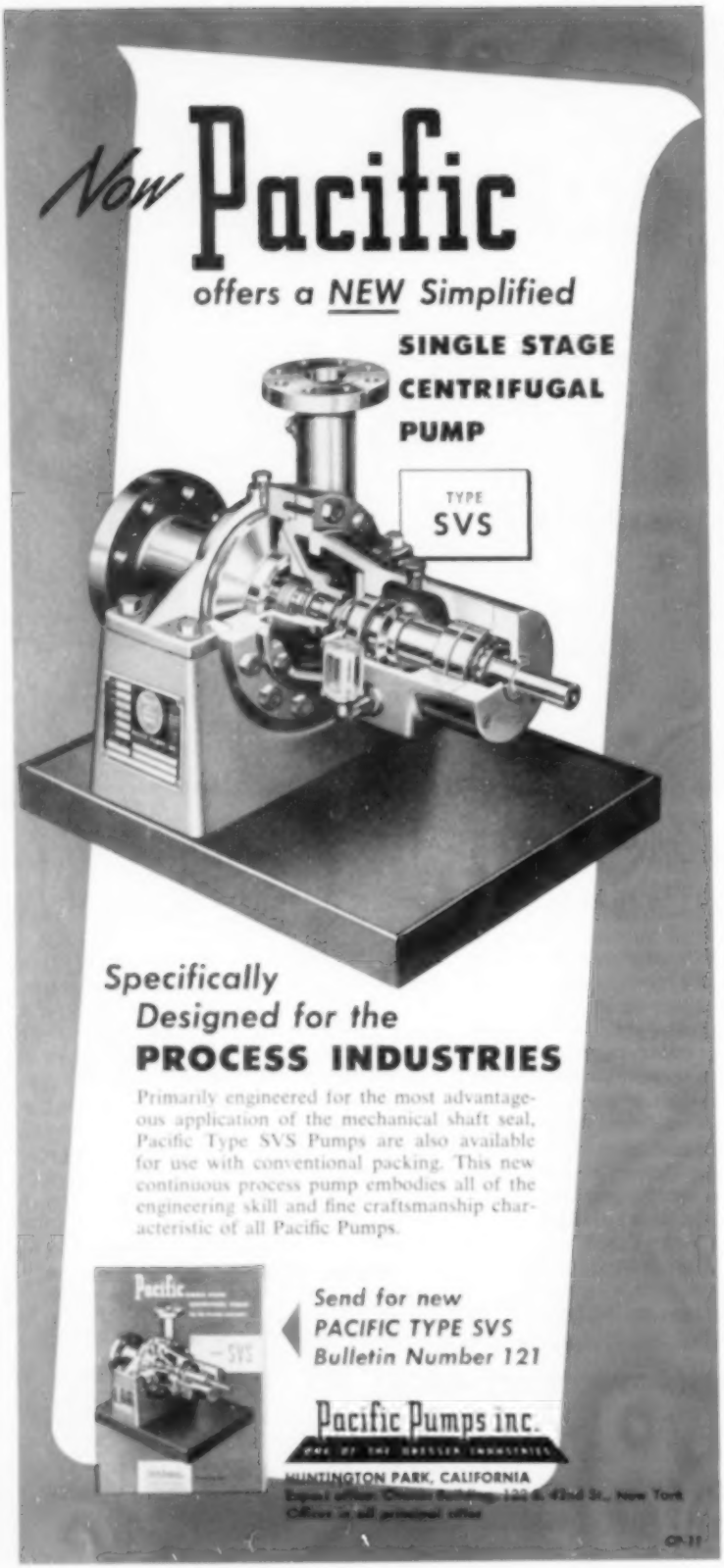
Midvale engineers, working with those of the chemical company, designed this converter to fit the specific needs of the plant. At one end of the vessel with full diameter opening the head is held on by a screwed yoke. Sealing is effected by a triangular-shaped copper gasket, sealing force attained by set screws. The other end of the vessel is closed down to about one-half the main diameter, a cover bolted on and self-sealing steel gasket of the "delta" type used.

Converters, autoclaves, separators, high-pressure accumulators, reactors . . . Midvale can forge them for your plant to meet specific processing requirements of pressure and capacity. Let our engineers work with you from initial design to final installation.

THE MIDVALE COMPANY- Nicetown, Philadelphia 40, Pa.
Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

MIDVALE

FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS


Now Pacific
offers a NEW Simplified
SINGLE STAGE
CENTRIFUGAL
PUMP
TYPE
SVS
Specifically
Designed for the
PROCESS INDUSTRIES
Primarily engineered for the most advantageous application of the mechanical shaft seal, Pacific Type SVS Pumps are also available for use with conventional packing. This new continuous process pump embodies all of the engineering skill and fine craftsmanship characteristic of all Pacific Pumps.
Send for new
PACIFIC TYPE SVS
Bulletin Number 121
Pacific Pumps inc.
HUNTINGTON PARK, CALIFORNIA

Letters

Statistics to Eternity

To THE EDITOR: With reference to the article "Can Statistics Do Everything?" [August, 1954, pp. 1208-1211], we would like to say that your approval to release such an article appears to show considerable shortsightedness.

First, the science of statistics, which is based on conformance to probability, cannot be credited with the distorted picture presented by the authors who discuss "why statistics failed." In actual fact, the authors failed statistics. Upon arriving at the conclusion that approximately 54% of the available data had to be discarded to meet preconceived ideas about the process in question, the following questions should have been asked:

1—Do we want to produce a correlation that is based on carefully selected data and propose that it should be representative of plant performance, within the ranges of the variables studied?

2—Should we not include all available data, except those which can be safely assumed to be in "gross" error, and derive a correlation that—although it would not appear as exact as one from selected data; i.e., would have a lower correlation coefficient—would at least conform to recorded plant performance?

3—If we have to eliminate 54% of the data to answer question 1, should we not forget about attempting the correlation study?

Assuming it was desirable to obtain some sort of relationship for the process, it would be a confession of ignorance to be astounded when the subsequent plant data did not compare favorably with that estimated from a correlation derived from highly selected data.

In the evaluation described in the subject article, although a nearly perfect correlation was "fabricated" (having a correlation coefficient of 0.92), including the large amount of data which was eliminated would have reduced this coefficient very considerably indeed.

Predictions made from an equation developed from all the data would no doubt have been more satisfactory for estimating future performances, in any event it would have spread the distribution diagram in Fig. 3. However, we recommend multiple correlation techniques should only be used where experimental design techniques are impractical, and even then only

by people capable of both in the technology of the process under investigation, and in statistical theory.

Although the techniques of correlation analysis are mechanical, the interpretation of results requires considerable experience. The use of secondary variables often leads one into grave difficulties. In process units, the "error" is often not random but systematic, proceeding in jumps (perhaps change in laboratory solutions, etc.), and requires that data be randomly selected before beginning correlation studies. The authors, it would seem, were far from random in their choice of data used. We also note in passing that the authors are evidently unaware statistical techniques are applicable to the non-linear case, particularly in experimental design studies.

The second objection to the article was in the manner of presentation. It can be assumed that the shortcomings of the authors' analysis was recognized as evidenced by the short paragraph starting, "A distorted picture . . ." on page 1209. This paragraph, which is practically lost in the article, should have been printed entirely in bold type. In fact, the article would have been better presented as "How the Unskilled Can Go Astray Using Statistics."

The use of statistics, which when properly employed can be a valuable tool in engineering and process studies, can be materially hindered should "distorted pictures" of this nature be approved for publication in a magazine as widely read as PETROLEUM PROCESSING. There is enough difficulty in presenting a strong case for the merits of the statistical approach to those in authority in industry, since the language of statistics is practically foreign, and the approach so different from old rule-of-thumb procedures.

After the excellent series of articles "Statistics for Everyday Use" published in your magazine [April, May, and June, 1954], the inaccuracies and distortions of "Can Statistics Do Everything" came as quite a letdown.

R. J. DEAM, and
W. H. LEOPOLD

Research & Development Dept.
The Bahrain Petroleum Co. Ltd.
Awali, Bahrain
Persian Gulf

• *Readers Deam and Leopold have joined in what the Editors are pleased to learn is a very controversial point. Following is the author's reply to the preceding criticism:*

Instead of discussing the fundamental shortcomings of statistical approach

BURRELL "For Scientists Everywhere"

presents THE FRACTON®

A New Instrument For Analysis of Light Hydrocarbons

2 to 3 Times Faster!

For:

NATURAL GAS

GASOLINE PLANT GASES AND LIQUIDS

REFINERY GASES

CYCLING PLANT GASES

LIQUEFIED PETROLEUM GASES

SYNTHETIC RUBBER INTERMEDIATES

PLASTIC INTERMEDIATES

PETROCHEMICAL GASES

and other light hydrocarbons

THE FRACTON CUTS ANALYSIS TIME AND EXPENSE, IMPROVES ACCURACY AND IS EASIER TO OPERATE

Request your Copy of FRACTON BOOKLET No. 82

The Fracton separates, identifies, collects and measures the components and records the analytical data in fifty to seventy-five percent less time than former methods. Users get superior accuracy and reproducibility with this new improved and simplified instrument.

® TRADEMARK

BURRELL CORPORATION
2223 FIFTH AVENUE, PITTSBURGH 19, PENNSYLVANIA
Manufacturers and Distributors of
SCIENTIFIC APPARATUS and LABORATORY CHEMICALS

(To obtain more data on advertised products see page 564)

to the solution of problems, Messrs. Deam and Leopold discuss the technique.

Statistics is a tool. And like arithmetic, algebra, or any other brand of mathematics, it cannot produce an idea. However, it is excellent for concealing an error or leaving a variable undetected. In his book, "How to Lie with Statistics," Huff discusses the shortcomings of statistical methods, but unfortunately few statisticians are willing to meet the criticism and face the facts. Obviously the theory of probability has the same basic weakness as statistics. We use it when we do not know what the two variables are or if we cannot control them. We are justified in using statistics as long as we understand its limitations.

The questions raised by Deam and Leopold are not fundamental, but technical. They are answered as follows:

1—Unfortunately, data obtained from the plant must be analyzed before they can be used for correlation purposes. Many runs must be discarded because of glaring discrepancies due to human and other errors inherent to plant operations. Otherwise a conclusion might be reached that no variable has any effect on yield and quality of plant products.

2—The answer here is the same as to question 1. In fact, all the data except those which were in "gross" error were used in determining the equation. However, "gross" error is a qualitative, not a quantitative term and is subject to individual interpretation, another weakness of statistics.

3—The answer is "certainly." The whole objective of the article was to demonstrate this very point.

Multiple correlation technique is excellent, but we would like to know what kind of an equation is recommended for fitting human errors into a mathematical expression which can be analyzed statistically.

Statistics is not a mystery, even though it uses a peculiar "lingo" of its own. Skill is needed not in using the statistical methods but in seeing that statistical answers must be accepted with a grain of salt before they are tested by the inductive and deductive methods of reasoning, based on methodical and careful experimental studies.

R. S. BRADLEY

• *Thank you, gentlemen, for your contributions to our knowledge on statistics.* PETROLEUM PROCESSING *has still more articles on the way to provide readers more information in this field.*

Lube Oil Additive performance verified by actual field tests

Pistons from field tests in 8-cylinder Diesel engines engaged in continuous high-load pumping service. Piston at left (625 hours, HD oil) shows severe ring sticking and high wear. Piston on right (1,582 hours, properly compounded oil) shows no ring sticking, low wear.

Ask about Oronite's "custom-formulation" to your needs

There is no substitute for field testing. At Oronite, laboratory engine tests are made to establish compounding levels required for various field conditions. These tests are then correlated with actual field operating conditions to verify performance of the compounded oil.

Oronite specializes in "custom-formulating" additives to your exact needs - meeting your price and performance specifications. Because of Oronite's advanced research program, elaborate testing and manufacturing facilities, Oronite's "custom-compounding" packs more into your oil at a given treating cost.

Why not talk over your problems with an Oronite additive specialist. Contact our office nearest you.

With Oronite Additives you can formulate oils to meet the new A.P.I. Service Classifications and can meet specifications for 2-104-B, MIL-O-2104, Supplement 1 and Series 2 oils.

OTHER ORONITE PRODUCTS
Gas Odorants
Polybutenes
Phenol
Wetting Agents
Fuel Oil Additives

ORONITE CHEMICAL COMPANY
200 Bush Street, San Francisco 20, California
30 Rockefeller Plaza, New York 20, New York
20 North Wacker Drive, Chicago 6, Illinois
714 W. Olympic Blvd., Los Angeles 15, California
Mercantile Securities Building, Dallas 1, Texas

ORONITE CHEMICAL COMPANY

(To obtain more data on advertised products see page 564)

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

April ★ One of a Series of Interest to the Petroleum Industry ★ 1955

THE "SIGN" OF A GOOD CUSTOMER

This booklet can help your dealers to recognize it . . . and profit from it

Credit customers, as you know, are generally *good* service station customers. They buy, for example, an average of *three gallons* more gasoline than cash customers and spend almost a *dollar* more per sale.

But many service station dealers and attendants fail to realize the value to them of these important customers. So to help your dealers get a better picture of the credit sales potential, we suggest that you distribute the above booklet to them. Entitled "A look at the credit customer," it is No. 3 in Du Pont's new "Looking through the windshield" series.

Any Du Pont Petroleum Chemicals Division representative or regional office will give you sample copies of these booklets . . . and cost information on ordering them in large quantities.

OCTANE NUMBERS— *Where are they going?...*

Here's how the Du Pont Quarterly Motor Gasoline Quality Survey can be of real value to you for long-range planning.

The average research octane numbers of all gasoline produced by the American petroleum industry have been steadily rising since the end of World War II. This average has risen from 84.3 in 1949 to 88.3 in 1954. The above figures are based on averages for both "regular" and "premium"—weighted on an area-grade-volume basis.

Of particular interest is the fact that the rate of increase during 1954 was nearly twice the rate of increase during 1952 and 1953.

And, based on the many new catalytic reforming facilities expected to come into operation during 1955, no slackening in this rapid rate of increase in octane numbers is expected to take place during this year.

The above information gives you an over-all picture of the national trend. But how do you relate it to your own individual situation? . . .

Right in your copies of the Quarterly Du Pont Motor Gasoline Quality Survey are all the details you need for applying the national trends to your own local marketing situation. With a number of previous issues in front of you, you will notice that almost every city or area tends to keep its own relative position in the over-all trend.

It is in analyzing and forecasting these long-range trends on a marketing area basis that your Du Pont Quarterly Survey can be most valuable to you. And each year, as new reports are added to the survey, it becomes more valuable as a planning aid.

New Movie to Help Your Dealers Cope with KNOCK Complaints

"When the customer says 'KNOCK'" is the title of a new movie that offers your dealers a quick visual education on how to answer knock complaints in a salesmanlike way.

It is a 15-minute live-action sound movie in full color. Introduced by Tom McCahill, noted automotive writer and car authority, the film was produced by the Du Pont Petroleum Chemicals Division for oil company use.

DRAMATIC PROOF of the mechanical, natural and human causes of knock are clearly demonstrated in the movie by the chassis dynamometer.

The film explains dramatically the seven most common causes of knock—none of which are caused by gasoline quality. It gives dealers a clear, concise picture of how such things as temperature and altitude, poor mechanical adjustments, and bad driving habits cause knock. To help demonstrate these points the two-story chassis dynamometer at the Du Pont Petroleum Laboratory is shown in action in the film.

Familiar situations

To dramatize the causes of knock and make them readily understandable to dealers and customers, typical motorists driving several different popular makes of cars are shown encountering engine knocking problems under familiar, everyday

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED "Knock" Movie

driving conditions. This part of the movie also dramatizes the reactions of many customers whenever they hear an engine knock . . . a reaction which frequently, and erroneously, causes them to blame the gasoline rather than the true cause of the knock.

The problem of Ed Gilbert, a character in the film, is typical. Ed is shown driving his '54 Ford sedan down to the plains from a high mountain area where his home is and where much of his driving is done. As soon as he starts pushing his car across the low-level plains country, the engine begins to knock.

And what does Ed do about that knock?

He immediately decides the gasoline brand he's been using is no "blankity blank" good. And he, therefore, decides to switch his brand immediately.

Who's the real villain?

But will the switch really solve Ed's problem? Of course not. The villain causing the knock is the change in altitude. And the solution to this problem is a proper adjustment in the carburetor setting.

Other common causes of knock are graphically and dramatically explained in the movie. Examples of knock caused by changes in humidity and temperature . . . by mechanical factors such as an over-advanced spark, or a faulty water pump, thermostat or fan belt . . . and by poor driving habits are all included.

Good public relations

The more your dealers know about the common causes of knock, and the more of this knowledge they are able to pass along to their customers, the less you and your products are likely to be blamed for engine knocks.

The new Du Pont movie, "When the customer says 'Knock'," can help you tremendously in this important work. What's more, with its live-action drama and easy-to-understand dynamometer demonstrations, it is also suitable for showings to customer groups.

Available to you

A limited number of prints of this new movie are now available for your use. More are being made. Before you order yours, we suggest you contact our local representative for an advance showing.

ASSISTANT GULF COAST REGIONAL MANAGER

BARRY V. CORNWALL is now assistant manager for the Du Pont Petroleum Chemicals Division's Gulf Coast Region with headquarters in Houston, Texas. He was recently transferred to this post from the Division's Eastern Region, where he also served as assistant regional manager.

Since 1929, Mr. Cornwall has been continuously associated with the Du Pont Company. Following his first assignment as a technician in the service laboratory of the Dyestuffs Division, he became a salesman for the Alcohol Division's anti-freeze and industrial solvents. He later became assistant sales manager of the Alcohol and Camphor Section. He then joined the Petroleum Chemicals Division in 1952 as technical assistant to the director of sales.

Mr. Cornwall was born in Winnipeg, Canada, and graduated from Clemson College in South Carolina. During World War II, he served four years in the U. S. Army.

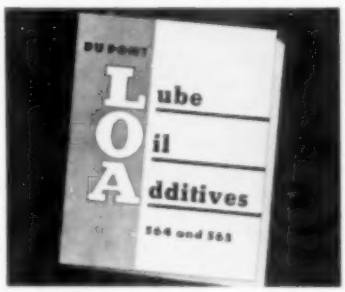
Write for this new book on Du Pont Lube Oil Additives

Polymeric lube oil additives combining effective low-duty detergency and V. I. improver qualities are a new and revolutionary development. And, until now, adequate information on their properties, application, and methods of addition has not been readily available.

A comprehensive discussion of these additives, however, is now available in a single book. This book, "Du Pont Lube Oil Additives 564 and 565" covers the basic aspects of this new development . . . including physical properties, low-temperature detergency and diesel detergency; effect on inspection data and bench test performance of oils; viscosity index improving characteristics; low-temperature wear properties and bearing corrosion characteristics. Details on toxicity and handling are also included.

The book is well illustrated with photographs of parts from test engines and detailed performance charts.

Copies are readily available from any Du Pont Petroleum Chemicals Division representative or regional office listed below.



DU PONT

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

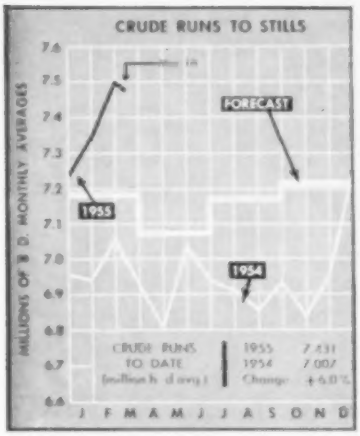
Regional Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas Phone COlumbus 5-2342
CHICAGO, ILL.—8 So. Michigan Ave. Phone RAndolph 6-8630
TULSA, OKLA.—P. O. Box 730 Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. Phone BLackstone 1151
LOS ANGELES, CALIF.—612 So. Flower St. Phone MAdison 5-1691

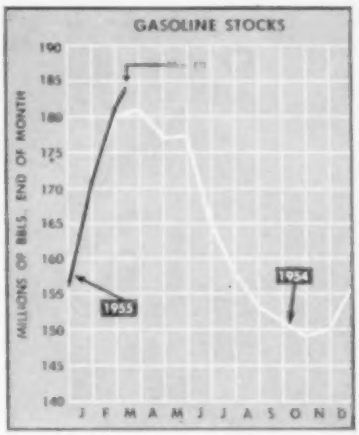
IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division, 80 Richmond Street West, Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

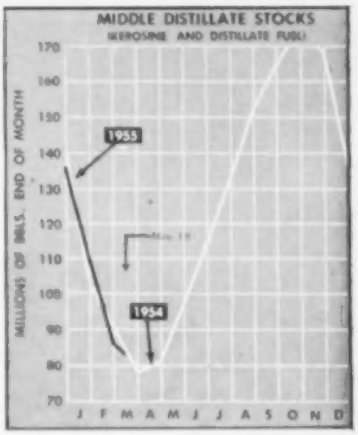
ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-9140

Printed in U. S. A.







High Runs Menace Market Stability

OUTLOOK: Overall crude runs should be cut by 250,000 bbls. daily, if excessive gasoline inventories this summer are to be avoided.

REFINERS in the U. S. in early March were charging 6% more crude to their stills than in the corresponding period in 1954, a considerably higher rate than required for product demand in coming months. Overall gasoline stocks March 11 were about 5,600,000 bbls. greater than the year before. Refiners met a demand for middle distillates during December, January and February about 12% larger than in the same period the year previous. Yet their inventories for kerosene distillate fuels March 11 were only about 1,260,000 bbls. less than the year before.

Compared with a year ago, crude runs have been stepped up most in the Gulf Coast districts, where in early March they were 12% greater; the Ind.-Ill.-Ky. district was charging 9% more crude. East Coast refiners were running 4% more oil.

Total U. S. gasoline inventories in refiners' hands March 11, 183,424,000 bbls., were approximately 3% larger than on March 12, 1954. This might be considered in line with the forecast increase in gasoline demand this year of about 4%. However, these inventories last spring were top-heavy. Overall stocks of around 160,000,000 bbls. by May 1 would be ample, the oil companies estimate. A year ago they were 177,000,000 bbls. on that date. U. S. gasoline inventories at refineries have built up since Dec. 31 to March 11 by around 26,000,000 bbls., as against 20,000,000 bbls. in the same weeks in 1954.

Refinery output of middle distillates in January and February was 15.2% larger than a year ago in the same period, which enabled refiners to meet the heavier heating oil demand this season and still maintain a cushion of stocks close to the 1954 level.

The increased demand for residual fuel oil, both here and abroad, continues to reduce refiners' stocks. While the total for the U. S. is about the same as a year ago, these inventories east of California are nearly 4,000,000 bbls. less. California stocks are about 3,000,000 bbls. higher, but are being steadily cut down.

MARCH KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Mar. 1955*	Feb. 1955	Mar. 1954
CRUDE OIL			
U. S. Production	6.843	6.758	6.923
Imports	.825	.789	.654
U. S. Stocks	261.719	260.316	271.867
Runs to Stills	7.472	7.501	6.507
GASOLINE			
Refinery Output	3.504	3.547	3.261
Refinery Demand	3.507	3.263	3.331
Primary Stocks	183.953	181.754	181.297
MIDDLE DISTILLATES			
Refinery Output	2.133	2.258	1.811
Refinery Demand	2.331	3.101	2.240
Primary Stocks	82.788	86.358	77.803
RESIDUALS			
Refinery Output	1.211	1.245	1.168
Imports	.494	.557	.392
Total Supply	1.705	1.802	1.560
Refinery Demand	1.720	1.914	1.667
Primary Stocks	44.801	45.071	44.249

*Through Mar. 18.

PRODUCT AND CRUDE PRICES

Products—¢ gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	Mar. 1955*	Feb. 1955	Mar. 1954
Gasoline	11.29	11.29	11.77
Distillate Fuel Oil	9.32	9.32	9.16
Kerosine	10.71	10.71	10.57
Residuals	4.23	4.22	4.01
Above 4 Products	8.85	8.85	8.99
Lube Oils	16.81	16.58	17.03
Crude	2.82	2.82	2.82

REFINERY YIELDS

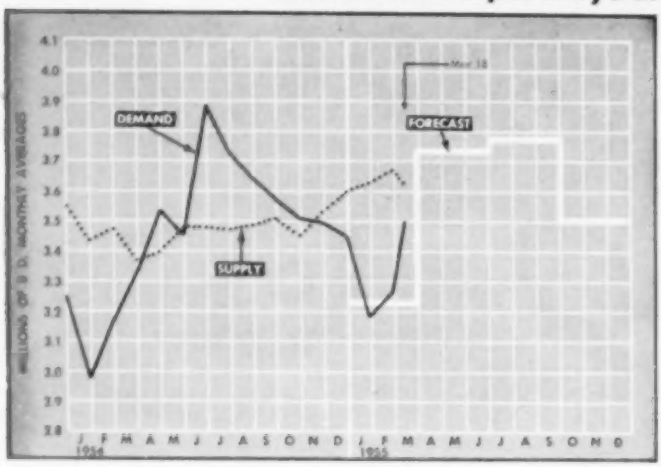
% on Crude Runs to Stills

	Mar. 1955*	Feb. 1955	Mar. 1954
Gasoline	42.7	42.8	43.4
Kerosine	5.0	5.1	5.2
Distillate	23.5	25.0	21.4
Residuals	16.2	16.6	17.1

*Through Mar. 18.

SOURCE OF DATA (except prices): Jan., Feb. and Mar., API weekly reports; earlier months, Bureau of Mines

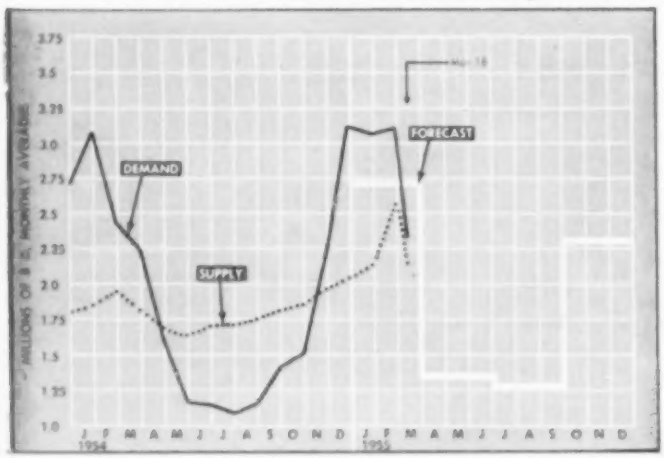
Motor Fuel Output Stays at High Level



MOTOR FUEL

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
Feb. '55	3.207	.463	3.670
Feb. '54	3.044	.432	3.476
Change	+.163	+.031	+.194
% Change	+5.4	+7.2	+5.6
DEMAND (including Exports) (Millions of b/d)			
Feb. '55			3.263
Feb. '54			3.182
Change			+.081
% Change			+2.6
TOTAL SUPPLY (Millions of bbls.)			
2 Mos. '55	189.260	25.891	215.151
2 Mos. '54	179.580	24.123	203.703
Change	+9.680	+1.768	+11.448
% Change	+5.4	+7.3	+5.6
TOTAL DEMAND (including Exports) (Millions of bbls.)			
2 Mos. '55			190.502
2 Mos. '54			181.629
Change			+8.873
% Change			+4.9

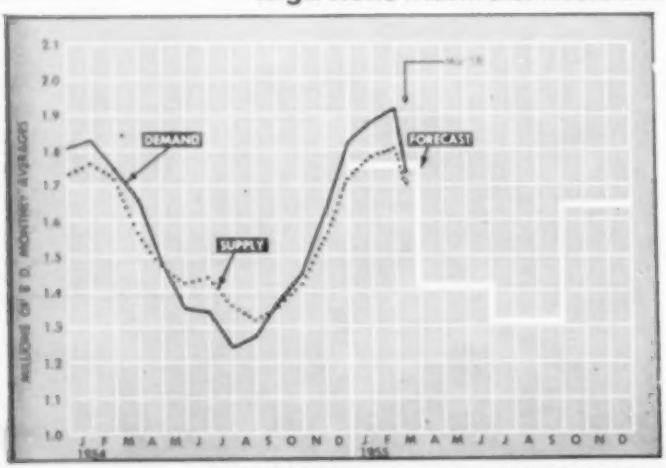
Sharp Seasonal Drop in Distillate Demand



MIDDLE DISTILLATES

	Kerosine	Dist. Fuels	Total
PRODUCTION (Millions of b/d)			
Feb. '55	.380	1.878	2.258
Feb. '54	.412	1.545	1.957
Change	—.032	+.333	+.301
% Change	—7.7	+21.6	15.4
DEMAND (including Exports) (Millions of b/d)			
Feb. '55	.563	2.538	3.101
Feb. '54	.478	1.939	2.417
Change	+.085	+.599	+.684
% Change	+17.8	+30.9	+28.3
TOTAL PRODUCTION (Millions of bbls.)			
2 Mos. '55	22.810	106.599	129.409
2 Mos. '54	23.628	88.730	112.358
Change	—.818	+17.869	+17.051
% Change	—3.5	+20.1	+15.2
TOTAL DEMAND (including Exports) (Millions of bbls.)			
2 Mos. '55	33.279	148.688	181.967
2 Mos. '54	32.129	130.897	163.026
Change	+1.150	+17.791	+18.941
% Change	+3.6	+13.6	+11.6

High Runs Maintain Residual Fuel Supply



RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
Feb. '55	1.245	.557	1.802
Feb. '54	1.241	.483	1.724
Change	+ .004	+ .074	+ .078
% Change	+ 0.3	+ 15.3	+ 4.5
DEMAND (including Exports) (Millions of b/d)			
Feb. '55			1.914
Feb. '54			1.753
Change			+ .161
% Change			+ 9.2
TOTAL SUPPLY (Millions of bbls.)			
2 Mos. '55	72.605	32.799	105.404
2 Mos. '54	74.152	28.576	102.728
Change	—1.547	+4.223	+2.676
% Change	—2.1	14.8	+2.6
TOTAL DEMAND (including Exports) (Millions of bbls.)			
2 Mos. '55			111.717
2 Mos. '54			105.828
Change			+ 5.889
% Change			+ 5.6

SOURCE OF DATA: Jan., Feb. and Mar., API weekly reports; earlier months, Bureau of Mines

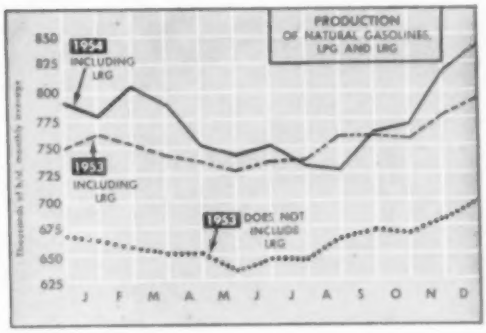
RUNS TO STILLS and DISTRIBUTION OF PRIMARY STOCKS BY U.S. REFINERY DISTRICTS

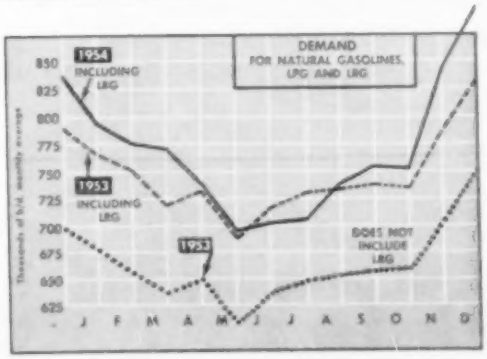
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Mar. 18 1955	Mar. 19 1954	Change	% Change	GASOLINE STOCKS (Millions of bbls., on date shown) Mar. 18 1955	Mar. 19 1954	Change	% Change	RESIDUAL STOCKS (Millions of bbls., on date shown) Mar. 18 1955	Mar. 19 1954	Change	% Change
East Coast	1.090	1.074	+ .016	+ 1.5	36.208	35.475	+ .733	+ 2.1	8.125	9.013	— .888	— 9.9
Gulf Coast	2.523	2.271	+ .252	+ 11.1	38.102	33.419	+ 4.683	+ 14.0	5.345	5.635	— .290	— 5.1
Total Coastal	3.613	3.345	+ .268	+ 8.0	74.310	68.894	+ 5.416	+ 7.8	13.470	14.648	— 1.178	— 8.0
Appalachian	.203	.191	+ .012	+ 6.3	7.335	6.733	+ .602	+ 8.9	.462	.844	— .382	— 45.3
Ind.-Ill.-Ky.	1.388	1.271	+ .117	+ 9.2	40.975	39.743	+ 1.232	+ 3.1	3.109	4.363	— 1.254	— 28.7
Okla.-Kans.-Mo.	.651	.596	+ .055	+ 9.2	19.542	19.753	— .211	— 1.1	.981	1.197	— .216	— 18.0
Other Inland	.623	.602	+ .021	+ 3.5	20.103	19.555	+ .548	+ 2.8	2.111	2.089	+ .022	+ 1.0
Total Inland	2.865	2.660	+ .205	+ 7.7	87.955	85.784	+ 2.171	+ 2.5	6.663	8.493	— 1.830	— 21.5
Total East of Calif.	6.478	6.005	+ .473	+ 7.9	162.265	154.678	+ 7.587	+ 4.9	20.133	23.141	— 3.008	— 13.0
California	.996	1.008	— .012	— 1.2	21.688	22.942	— 1.254	— 5.5	24.668	21.366	+ 3.302	+ 15.5
Total U. S.	7.474	7.013	+ .461	+ 6.6	183.953	177.620	+ 6.333	+ 3.6	44.801	44.507	+ .294	+ 0.6

District	DISTILLATE FUEL OIL STOCKS (Millions of bbls., on date shown) Mar. 18 1955	Mar. 19 1954	Change	% Change	KEROSINE STOCKS (Millions of bbls., on date shown) Mar. 18 1955	Mar. 19 1954	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbls., on date shown) Mar. 18 1955	Mar. 19 1954	Change	% Change
East Coast	23.097	22.215	+ .882	+ 4.0	8.153	7.845	+ .308	+ 3.9	31.250	30.060	+ 1.190	+ 4.0
Gulf Coast	8.578	8.342	+ .236	+ 2.8	3.282	3.010	+ .272	+ 9.0	11.860	11.352	+ .508	+ 4.5
Total Coastal	31.675	30.557	+ 1.118	+ 3.7	11.435	10.855	+ .580	+ 5.3	43.110	41.412	+ 1.698	+ 4.1
Appalachian	2.190	1.458	+ .732	+ 50.2	.748	.760	— .012	— 1.6	2.938	2.218	+ .720	+ 32.5
Ind.-Ill.-Ky.	10.272	9.678	+ .594	+ 6.1	4.465	3.726	+ .739	+ 19.8	14.737	13.404	+ 1.333	+ 9.9
Okla.-Kans.-Mo.	6.746	6.531	+ .215	+ 3.3	.902	1.127	— .225	— 20.0	7.648	7.658	— .010	— 0.1
Other Inland	3.980	3.878	+ .102	+ 2.6	1.131	.867	+ .264	+ 30.4	5.111	4.745	+ .366	+ 7.7
Total Inland	23.188	21.545	+ 1.643	+ 7.6	7.246	6.480	+ .766	+ 11.8	30.434	28.025	+ 2.409	+ 8.6
Total East of Calif.	54.863	52.102	+ 2.761	+ 5.3	18.681	17.335	+ 1.346	+ 7.8	73.544	69.437	+ 4.107	+ 5.9
California	8.872	10.510	— 1.638	— 15.6	.372	.318	+ .054	+ 17.0	9.244	10.828	— 1.584	— 14.6
Total U. S.	63.735	62.612	+ 1.123	+ 1.8	19.053	17.653	+ 1.400	+ 7.9	82.788	80.265	+ 2.523	+ 3.1

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS

(Bureau of Mines Data)

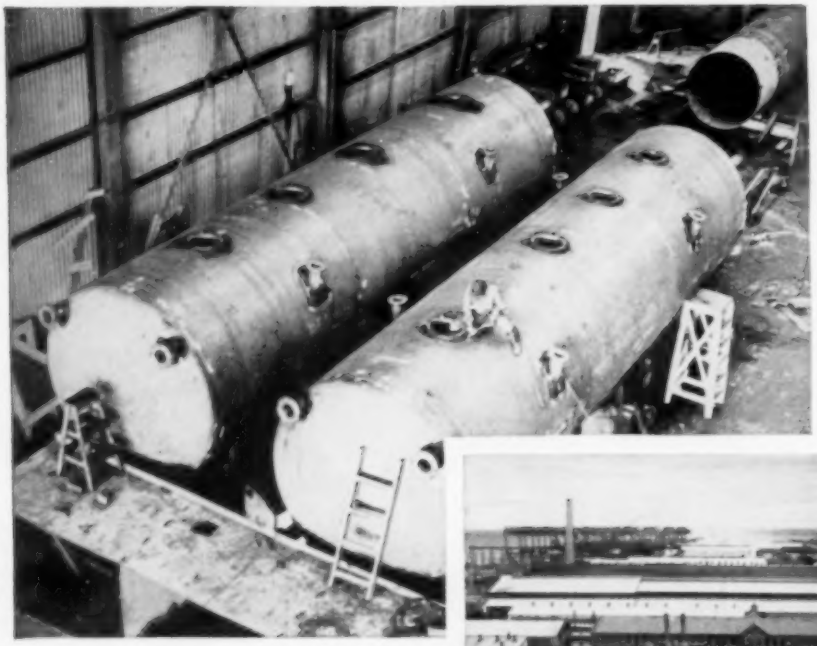
CURRENT PRODUCTION (1000 b/d monthly average)	Dec. 1954	Nov. 1954	Dec. 1953
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	372	360	344
Natural Gasoline and Isopentane	263	274	253
Condensate	25	23	28
Finished Gasoline, Naphtha and Other	73	65	75
Total Natural Gasoline and Cycling Plant Production	733	722	700
Liquefied Refinery Gases	107	97	91
Total Marketable Gas Liquids	840	819	791
Lease Condensate	107	102	94
Total Natural Gas Liquids	947	921	885

CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	544	473	461
Natural Gasoline, Isopentane and Other	356	373	368
Total Current Demand	900	846	829

CUMULATIVE PRODUCTION (1000 bbls.)	Dec. 1954	Dec. 1953
LPG and LRG	153,126	146,493
Natural Gasoline, Isopentane and Other	129,179	128,704
Total Marketable Gas Liquids	282,305	275,197

CUMULATIVE DEMAND (1000 bbls.)		
LPG and LRG	149,844	142,090
Natural Gasoline, Isopentane and Other	129,411	129,749
Total Cumulative Demand	279,255	271,839

STOCKS (1000 bbls., end of month)	Dec. 1954	Nov. 1954	Dec. 1953
LPG and LRG	7,759	9,787	4,480
Natural Gasoline, Isopentane and Other	4,656	4,481	4,885
Total Stocks	12,415	14,268	9,365



A Mile of Shops – Each shop is devoted to a special type of heavy production. Included are complete Machine Shops, casting, forging and other facilities which offer all of the advantages of the execution of the complete job.

A half mile of pressure vessels

These are two of seventy – over ½ mile – of 38½-foot vacuum tank casings built to meet the quality requirements of a well-known processor.

The buyer also benefits from many savings made possible by Newport News extensive heavy fabrication equipment and the sixty years experience in using it.

Do you plan installations of heavy production equipment? You can command the services of Newport News for weldments of corrosion-resistant, alloy and clad metals in almost any size or shape, plus the required engineering background and complete welding and stress-relieving skills.

It will pay you to get the facts, shown in *Facilities and Products*. As you glance at its photos and brief captions, you'll see why Newport News can turn out – at low cost – specialized heavy equipment for process plants.

Send for *Facilities and Products* – free – today.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

TEXAS CITY REFINERY

The Houdriflow unit of Texas City Refining, Inc. at Texas City, Texas is the principal element in an aggressive modernization and expansion program. The new 19,000 BPSD Houdriflow Catalytic Cracker went on stream in September, 1953. A charge consisting of vaporized gas oil from a flash tower, plus a liquid-phase mixture of heavy vacuum gas oil and recycle is being cracked into high octane gasoline.

At Texas City, and many other modern refineries, Houdriflow Catalytic Cracking plants are operating at the highest conversion levels ever achieved in the industry. All Houdriflow plants are charging heavy vacuum gas oils. An informative new brochure describing the Houdriflow Process is available on request. Write to: Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa.

HOUDRY

PROCESS CORPORATION

Pioneer in Catalytic Processes

Twin Vaporspheres earn their keep early

These twin 150,000-cu. ft. Horton Vaporspheres® have sufficient capacity to prevent essentially all standing storage losses caused by breathing from twelve interconnected cone roof storage tanks. They are located at Shell Oil Company's Dominguez Refinery, California. Calculations indicate that about 70 per cent of the previous total breathing and filling losses from the cone roof tank is retained in the system by the Vaporspheres. The remaining 30 per cent is recovered by a vapor recovery compressor.

Vaporspheres can do the same for you. Storing vapor displaced from interconnected fixed-roof tanks under a hemispherical flexible membrane inside the sphere, they will earn their keep early. Write our nearest office for further information.

CBI

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa • Washington

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

Mathieson Activated Alum: *settles water treatment problems*

Quick-dissolving and fast-settling, Mathieson sulphate of alumina is a superior filter alum specifically designed for industrial water and wastes treatment. Its porous structure enables it to go into solution fast. The finely ground natural silicates aid coagulation, form heavier floc, and allow a greater volume to be processed in each treatment period.

In chemical plants, pulp and paper mills, petroleum refineries, Mathieson Activated Alum is providing efficient, economical water treatment and helping to solve sensitive wastes disposal problems. Mathieson's technical service staff is available for advice and practical assistance on application and handling of sulphate of alumina in all industrial installations.

See if Mathieson Chemicals can't settle your water and waste treatment problems. In addition to Activated Alum, Olin Mathieson is a major producer of chlorine, ammonia, sodium chlorite (chlorine dioxide), HTH hypochlorite products, sulphuric acid, hydrazine, caustic soda, and powdered and fused soda ash (PH-Plus). Your Mathieson representative will put you in touch with the men who can best serve you—or write today for complete information.

MATHIESON CHEMICALS

OLIN MATHIESON CHEMICAL CORPORATION

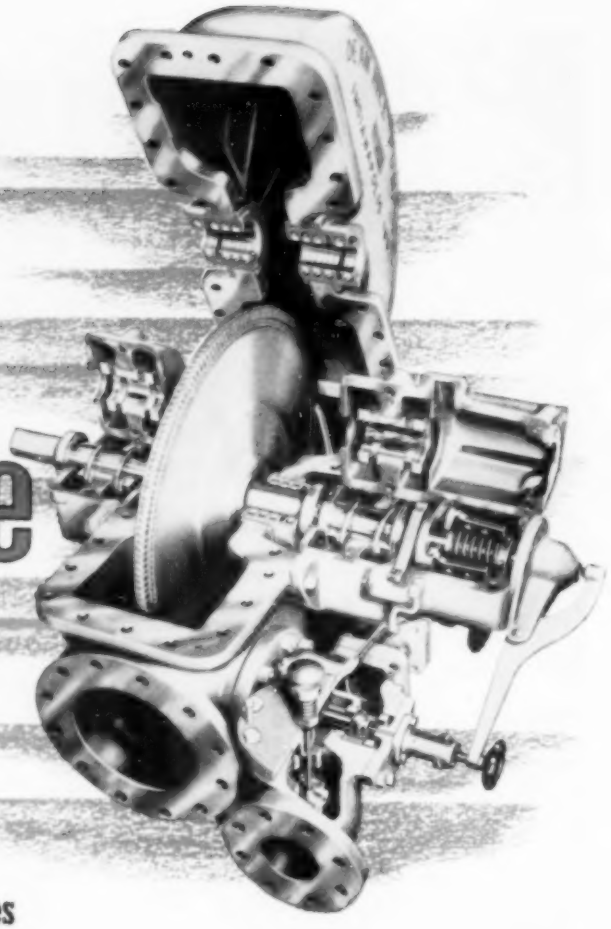
INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

MATHIESON

3052

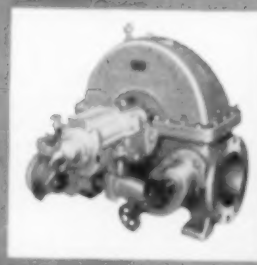
CAUSTIC SODA • SODA ASH • CHLORINE • SULPHURIC ACID • SULPHUR • AMMONIA • NITRATE OF SODA • BICARBONATE OF SODA • NITRIC ACID • SULPHATE OF ALUMINA • SODIUM CHLORITE PRODUCTS
ETHYLENE OXIDE • ETHYLENE GLYCOL • DIETHYLENE GLYCOL • TRIETHYLENE GLYCOL • POLYGLYCOLS • DICHLORDIETHYLETHER • ETHYLENE DICHLORIDE • METHANOL • SODIUM METHYLATE • ETHYLENE DIAMINE

up to 100% more power



added to DH turbines

More power from the same size unit! Dean Hill presents an improved DH Line of horizontal turbines which produce up to twice the power of former counterparts.



The major change contributing to this tremendous power increase is the addition of one or more steam nozzles to all models, with these results . . .

1. The new, two-nozzle DH-10 and DH-20 turbines have double the maximum horsepower of former units.

2. Models DH-30, DH-40 and DH-45, now with three nozzles, are rated 50% higher in maximum horsepower.

FULL INFORMATION AVAILABLE

Many other improvements have been made on the five DH Models, adding to the quality and performance of Dean Hill Horizontal Turbines. A new catalog completely describes these models, and this information will be sent you on request.

Write Today For Dean Hill's New Turbine Catalog No. 500.

DEAN DH HILL PUMP COMPANY

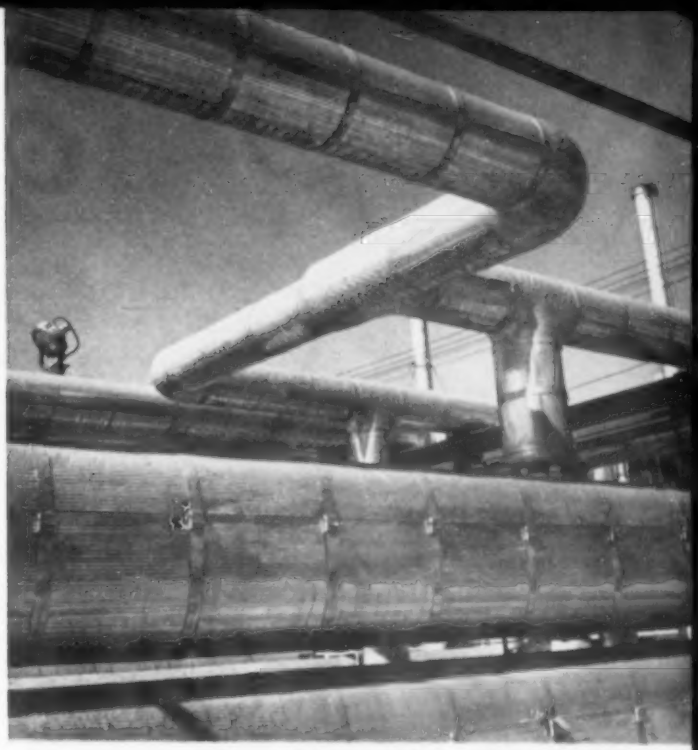
Pump and Turbine Engineers Since 1893

Indianapolis 7, Indiana

Chicago, New York, San Francisco, Boston, Cincinnati, Denver, Albuquerque, El Paso, Salt Lake City, New Orleans, Philadelphia, Tulsa, Los Angeles, Pittsburgh, Houston, Dallas, St. Paul, Toledo, Cleveland, Grand Rapids, Birmingham, Ala., Louisville, Memphis, Huntsville, Richmond, Eugene, Cal., Kansas City, Montreal, Reading, Pa., The Hague

How Olin Mathieson Uses Childers Jacketing For Insulated Lines

Jacketing problems at new plant ranged from covering tall towers to irregularly-shaped heat exchangers. Read how aluminum jacketing solved these problems.



More than 244,000 square feet of Childers .006" Jacketing and 35,000 square feet of heavy weight Childers Jacketing was used in this new Olin Mathieson plant to weatherproof insulated lines, towers and vessels. Close-up above shows how aluminum jacketing was applied with strapping and seals.

Low first-cost, long life, and easy installation were the big reasons Olin Mathieson Chemical Corporation used Childers Aluminum Jacketing for outdoor insulated lines in their new Brandenburg, Ky., petrochemical plant.

Mathieson used Childers standard weight Jacketing on their insulated lines. Heavier weights of Childers Jacketing were used on high towers and vessels where a stiffer material was needed to support the vertical weight of the jacketing.

Engineers report that Childers Jacketing is inexpensive to apply. It comes in easy-to-handle rolls 4 ft. wide and 100 ft. long. Just pliers and a pocketknife are the only tools needed to apply. And because the jacketing is aluminum it needs no painting . . . stays clean and new looking even after years of service.

Childers Jacketing is easily removable, too. Just remove the strapping and jacketing can be taken off for inspection of the lines. Then same jacketing can easily be put back on the insulated line.

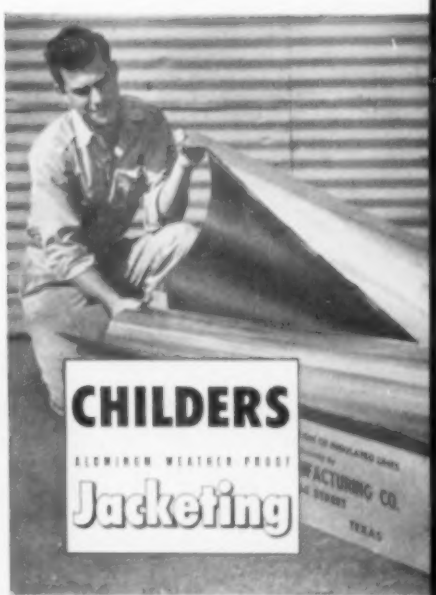
Immediate shipment from our large factory stocks can eliminate costly delays in construction or plant improvement schedules.

Try this low-cost protection in your plant. Write today for engineering data and information. You can order a 400 sq. ft. roll to test on one of your insulated lines. No obligation. Address: Childers Manufacturing Company, Department PP-8, 3620 West 11th St., Houston, Texas.

How to apply Childers Jacketing:

1. Best method of attaching jacketing is aluminum strapping and seals. Strapping can be pulled plenty tight with pliers like this. Other method is to use sheet metal screws.

2. A two-man crew can apply jacketing fastest. No special shop work or roll forming is necessary. Only tools needed are a pliers and a screw-driver or wooden wedge.



Each roll of Childers Jacketing comes individually packed like this in a heavy corrugated carton. Rolls are 4 ft. wide. With moisture barrier attached they are 100 ft. long; without moisture barrier they are 200 ft. long. They are well protected for field storage if kept dry. Individual boxes are light enough for one man to handle. (Adv.)

WE'VE CRACKED THE OCTANE BARRIER

Rexfo

*Pioneered by the Developers of Platforming —
The Industry's First Platinum Catalyst Reforming Process.

r m i n g*

A completely new standard of octane quality is now available to all refiners thru REXFORMING† — a development that employs an entirely new concept in producing gasolines with clear octanes in excess of 100. And REXFORMING does this economically and continuously without limitations as to type of crude processed in the refinery.

Another important fact is that REXFORMING will make gasolines of any intermediate octane that the refiner may require.

REXFORMING is one more development pioneered by Universal — a significant milestone in the never-ending progress of petroleum refining technology.

Regardless of your present reforming operations, you'll ultimately need and want REXFORMING.

†Trademark

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD,
DES PLAINES, ILL., U. S. A.
Laboratories: RIVERSIDE, ILLINOIS

Universal Service
Protects Your Investment

Meet the Tubes that Meet Your Needs

B&W Seamless and Welded Carbon, Alloy and Stainless Tubing for Condensers and Heat Exchangers

CARBON STEEL

This grade is used where service conditions are mild, that is, where the temperatures involved are relatively low and corrosive attack is not anticipated.

LOW CHROMIUM STEELS

The addition of chromium and molybdenum give these alloys good strength at elevated temperatures and improved resistance to oxidation as well as resistance to deterioration in services involving some hot corrosive gases.

INTERMEDIATE CHROMIUM STEELS

These grades have applications similar to those of the low chromium group except the additional alloying elements improve their characteristics and permit higher operating temperatures. They are particularly adapted to the handling of oils or hydrocarbon fluids containing sulphur compounds.

NICKEL STEELS

These steels are particularly suited for handling neutral salt solutions such as sodium and potassium nitrate or sulphate. They have found service in the black liquor evaporators of soda and kraft paper mills. Another field of application has been in sub-zero temperature service where high impact resistance is also a necessity.

STAINLESS STEELS

These steels are for specialized application where service conditions are extreme, that is, where corrosive environments or high temperatures are problems. The stainless steels have wide usage in the chemical industries, petroleum refinery, paper making, drug preparation, food processing and dairy and beverage industries.

For sound assistance in meeting your specific tubing requirements, write for Bulletin TB-329A or, better yet, get in touch with Mr. Tubes, your link to B&W. He represents B&W's headquarters technical staff and strategically located district offices, and B&W's nationwide network of fine tubing distributors.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa. and Milwaukee, Wis.: Seamless Tubing, Welded Stainless Steel Tubing
Alliance, Ohio: Welded Carbon Steel Tubing
Milwaukee, Wis.: Seamless Welding Fittings

B&W SEAMLESS and WELDED TUBES

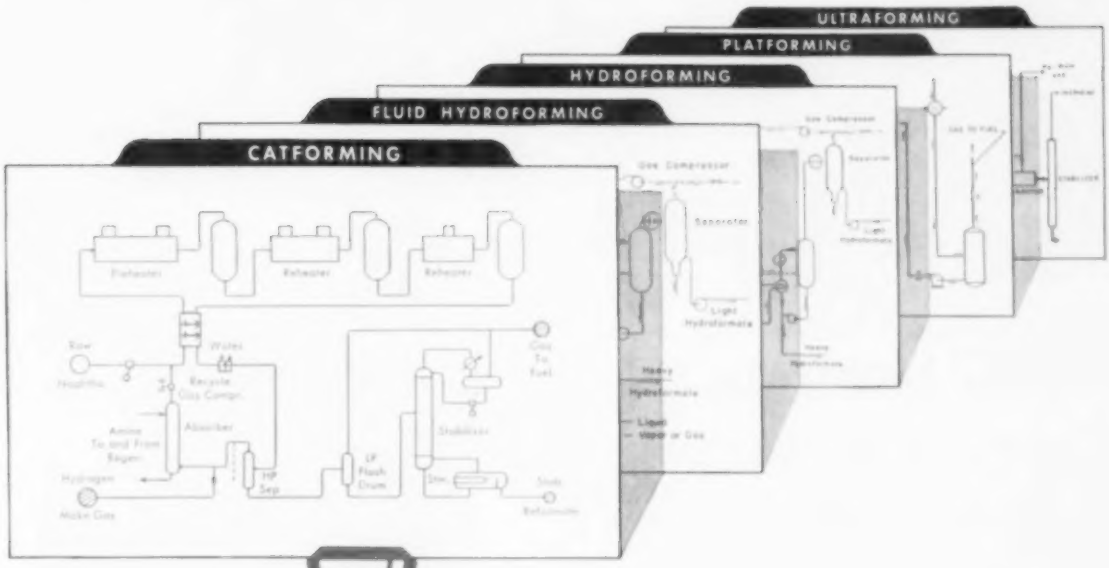
TA-4044(CWP)

which method of

CATALYTIC REFORMING

is best suited to your needs

...FLUID or FIXED BED?



Here's why FW can give you the right answer

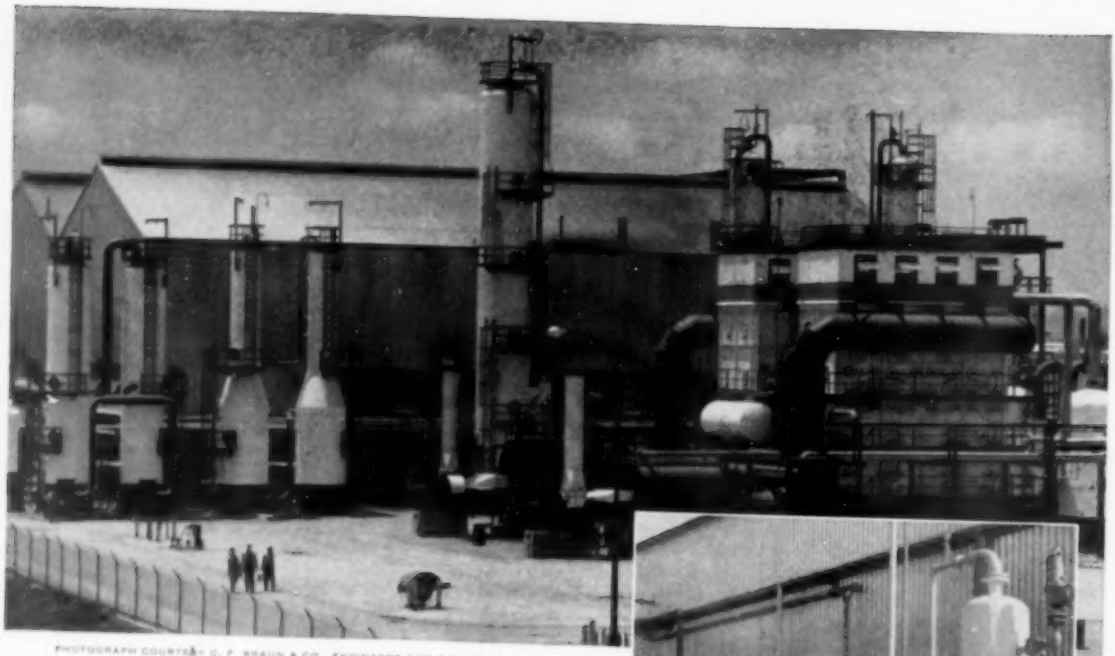
...and supply the complete job, too!

The success of catalytic reforming has led to the development of many different methods — both fluid and fixed bed. Selection of the most economical and efficient process for any given installation therefore poses an interesting problem.

Foster Wheeler has completed an extensive economic study of the relative values of the fluid method of catalytic reforming versus the various fixed bed methods. It was found that each has its merits . . . and its limitations. Proper selection depends on plant size, quality of charging stock, octane requirements and other factors.

Our wide design, engineering and construction experience in both fluid and fixed bed catalytic reforming is at your service. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER



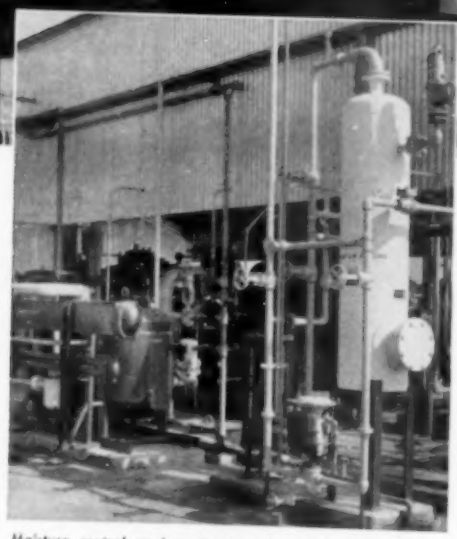
PHOTOGRAPH COURTESY C. F. BRAUN & CO., ENGINEERS AND CONSTRUCTORS

BREA CHEMICALS, Inc. prevents process errors by DRYing instrument air

When an instrument *lies*, a process suffers. Even on a dry day, outside air contains enough moisture to condense and foul or corrode delicate instrument parts . . . reducing instrument accuracy.

Brea Chemicals uses a Lectrodryer* installed at the compressor to remove moisture from incoming air continuously and make corrosion damage of this sort impossible. Also, a Lectrofilter* removes oil and grime from the air so that only clean, dry air ever enters Brea's instrument lines.

Instrument-air Lectrodryers are available in many sizes to provide a continuous supply of dry air, automatically if desired, to the limit of your needs.



Moisture control on instruments and control panels for six separate plant areas is handled by this Lectrodryer.

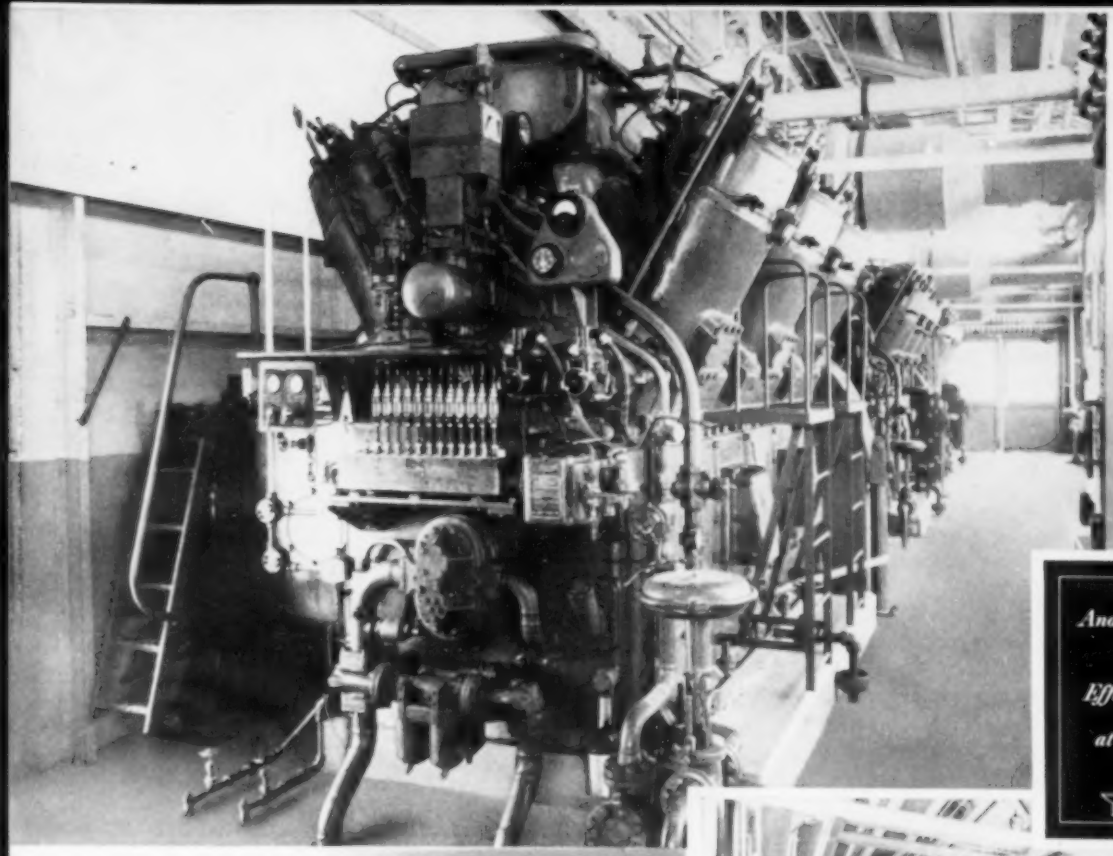
Write for *Because Moisture Isn't Pink*, a booklet which describes industry's many uses for Lectrodryers in gas, air and organic liquid drying. Request dryness engineering information. Pittsburgh Lectrodryer Corporation, 332 32nd St., Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

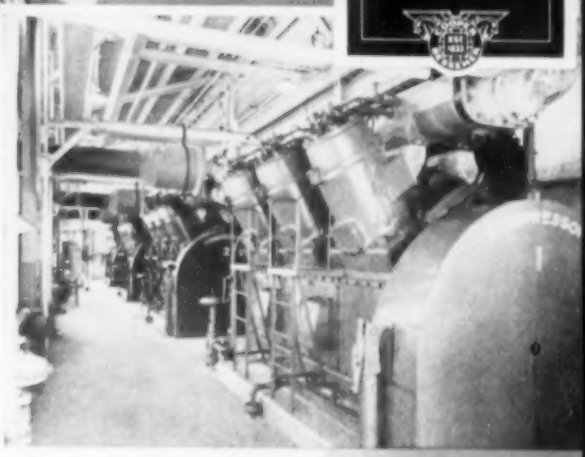
LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.



Another Example of Efficient Power at Lower Cost



Shown here are Cooper-Bessemer compressors, located at Sun Oil Company's Marcus Hook petrochemical plant. Used to handle recycle hydrogen, these four GMV's are each rated 660 hp at 300 rpm.

In hydrogen service for petrochemicals

COOPER-BESSEMER GMV's...

Where EXTREME Reliability is a MUST!

• In Sun Oil's $15,000,000 petrochemical plant at Marcus Hook, Pa., three 6-cylinder Cooper-Bessemer GMV compressors efficiently handle the recycling of hydrogen, while a fourth unit is in stand-by service. Three more similar units are being added for current plant expansion.

Employing both the Houdriforming and Udex processes, the Marcus Hook installation is designed to produce benzene, toluene and mixed xylenes, or high octane motor fuel. In the Houdriforming process, it is extremely important to maintain a continuous hydrogen supply.

Handling this vital recycle hydrogen, are 660 hp Cooper-Bessemer compressors . . . long recognized for the very best in *reliable service* and economical operation.

Like Sun Oil, you too will be performance ahead with highly efficient, trouble-free Cooper-Bessemers. So, if future plans call for compressor horsepower offering tops in dependability and flexibility, get complete facts on the latest V-angle developments.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

for aldehyde distillation
Stainless Steel

The towers, internals and piping of this distillation unit for aldehydes, in service at a petrochemical plant in the Southwest, take advantage of the corrosion resistance of Stainless Steel.

This growing industry is solving many of its problems of heat and corrosion with Stainless Steel. And in USS Stainless Steel you have a wide variety of compositions to meet almost any problem. Our booklet, "Performance of Stainless Steel in Petroleum Refinery Service," describes how USS Stainless Steel has met problems similar to those you are encountering. For your copy, write to United States Steel Corporation, Room 4658, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO • NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

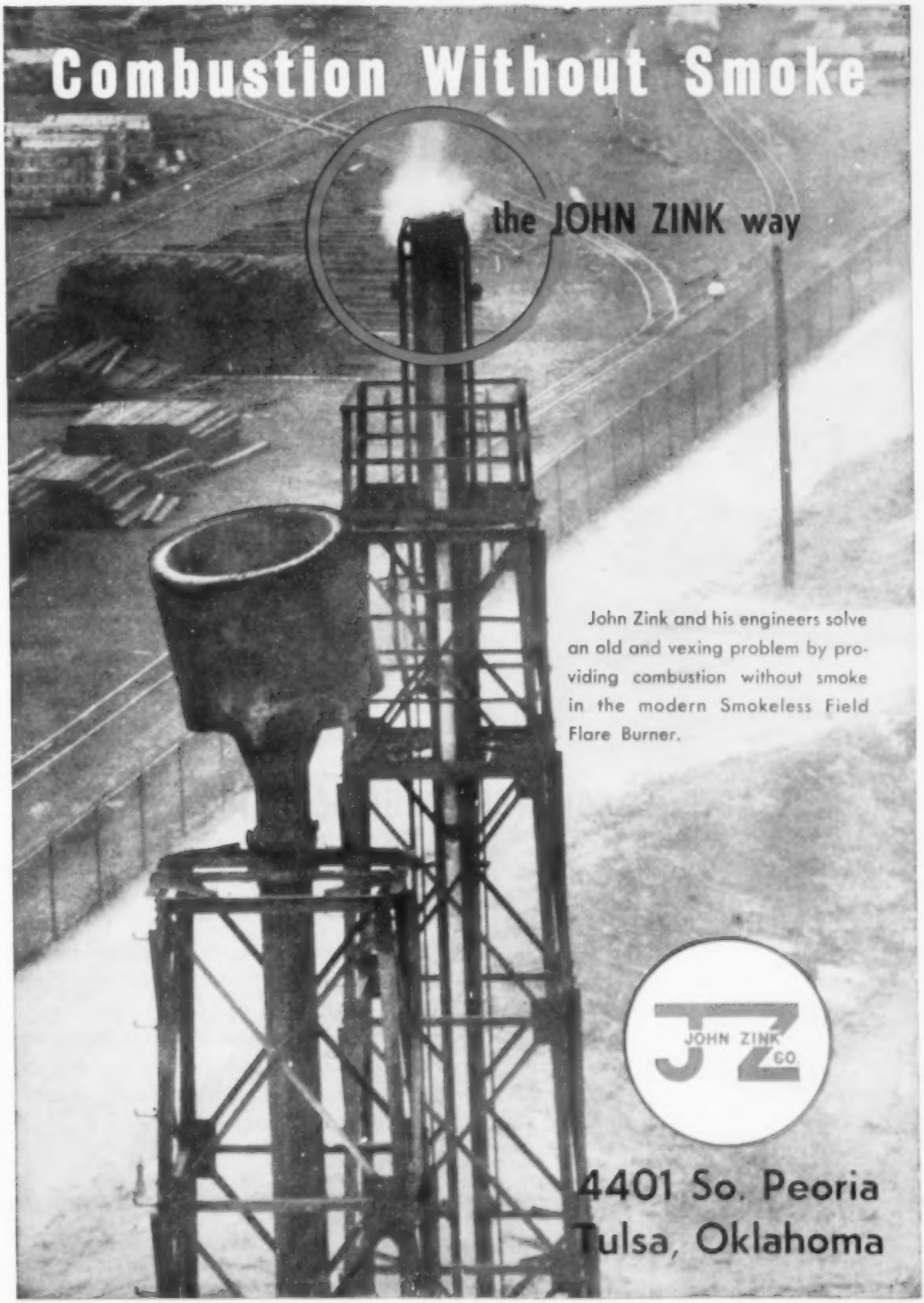
SHEETS · STRIP · PLATES
BARS · BILLETS

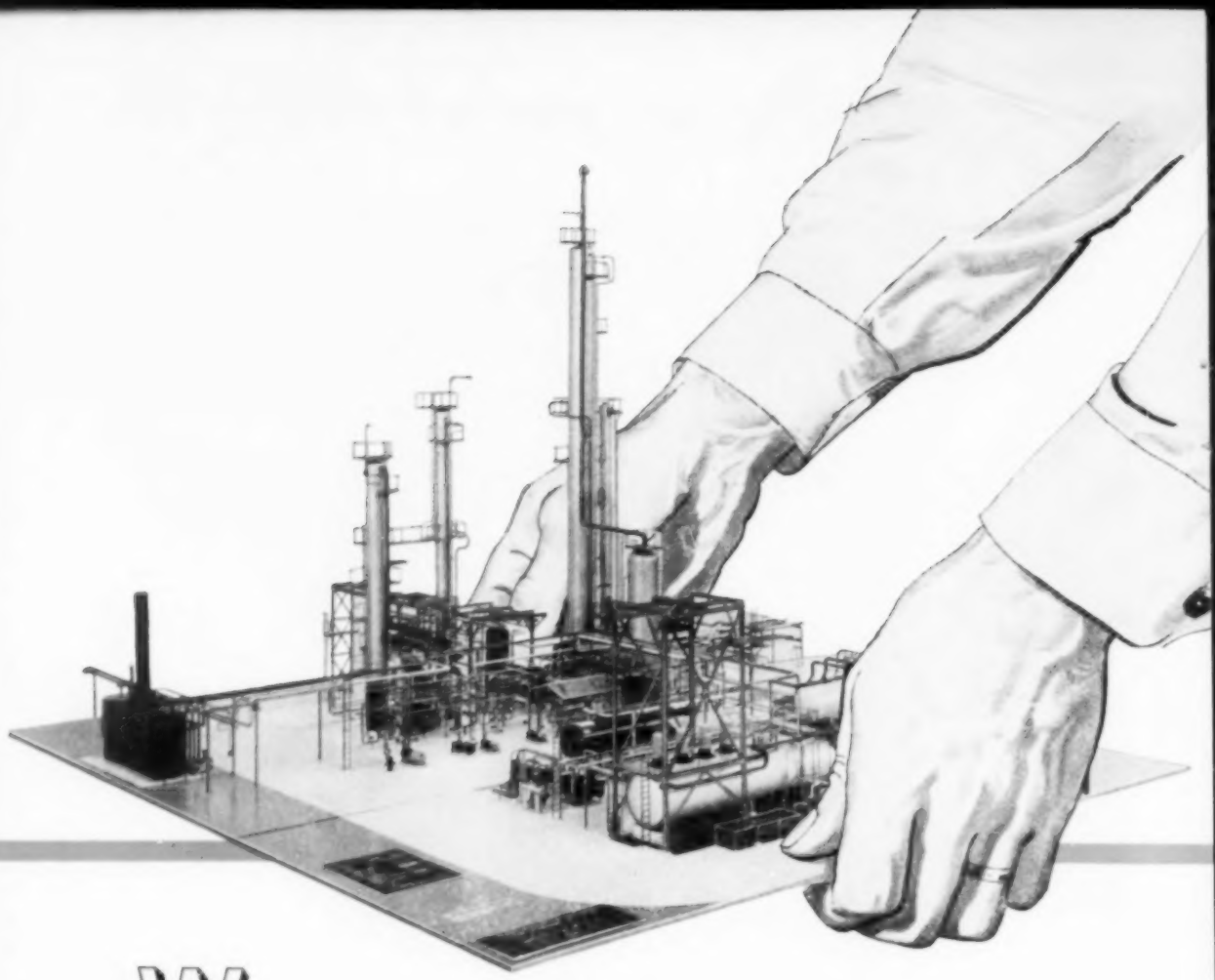
USS

PIPE · TUBES · WIRE
SPECIAL SECTIONS

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL


Combustion Without Smoke
the JOHN ZINK way
John Zink and his engineers solve an old and vexing problem by providing combustion without smoke in the modern Smokeless Field Flare Burner.
JZ
JOHN ZINK CO.
4401 So. Peoria
Tulsa, Oklahoma



Where do you want your new plant shipped?

EVER stop to think that your new plant will have to be shipped—literally in pieces—to the site?

That will take a lot of planning, buying, expediting and inspection of materials and equipment. These functions are all part of the complete design, engineering and construction services McKee renders, but the important factor is McKee experience—a half-century of world-wide experience that's available for all phases of your project from preliminary site study to completed plant ready for initial operation.

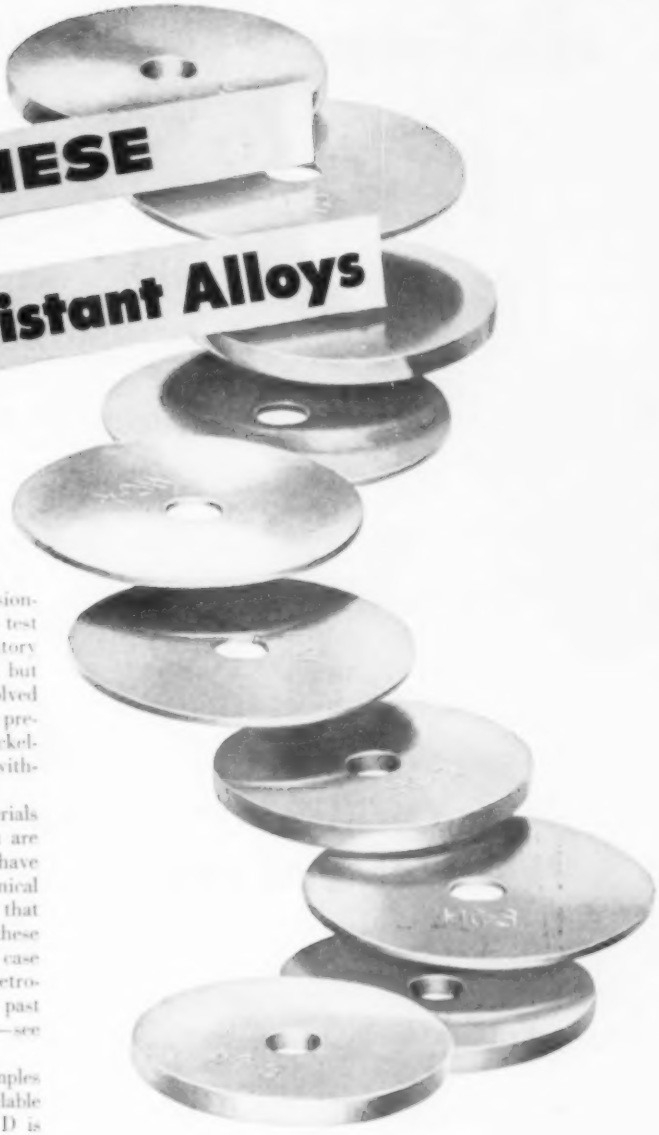
50th ANNIVERSARY

McKee Engineering Services

Arthur G. McKee & Company • Engineers and Contractors

Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York • Tulsa, Oklahoma • Union, N. J. • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

TEST THESE Corrosion-Resistant Alloys



. . . and see for yourself how economical they are

The only way you can be sure that a corrosion-resistant material will work in your plant is to test it under actual operating conditions. Laboratory tests will give you some idea of what to expect, but they don't show the effects of the variables involved in production operations. That is why we have prepared standard test specimens of HASTELLOY nickel-base alloys . . . and they are available to you without cost.

Test these alloys yourself against the materials you are now using, or against others that you are considering using. Prove to yourself that they have exceptional corrosion resistance . . . high mechanical strength, even at elevated temperatures . . . and that they are economical to use. We can support these claims with records of laboratory tests and with case histories of actual installations in chemical, petroleum, textile, and metalworking plants over the past 20 years. But don't take our word for it—see for yourself.

Use the handy coupon below to order your samples of HASTELLOY alloys. Alloys B, C, and F are available in either cast or wrought forms, while alloy D is supplied as castings only. If the equipment you have in mind is to contain welded joints, be sure to advise us, so that we may furnish you with welded samples.

These standard spool-type test specimens of HASTELLOY alloys are available on request.

"Haynes" and "Hastelloy" are registered trade-marks of Union Carbide and Carbon Corporation.

HAYNES Trade-Mark *alloys*

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC

USE THIS HANDY COUPON

Haynes Stellite Company, UCC, Park & Lindsay St., Kokomo, Ind.

Please send me, without obligation, the following samples of HASTELLOY alloys: (Please Check)

CAST				WROUGHT		
☐ B	☐ C	☐ D	☐ F	☐ B	☐ C	☐ F

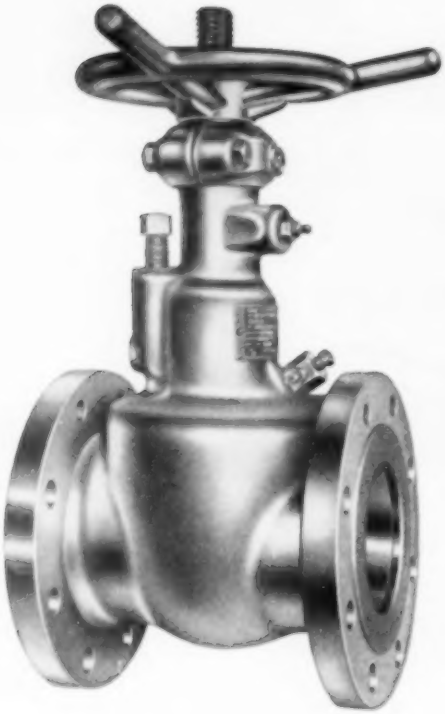
☐ Above samples should have welded joints.

NAME_____

COMPANY_____

ADDRESS_____

(To obtain more data on advertised products see page 564)



MAXIMUM FLOW

characteristics

with MINIMUM

pressure drops

ORBIT VENTURI VALVES

When you buy Orbit Forged Steel Venturi Valves, you can be sure that they are designed to give maximum flow characteristics with minimum pressure drops.

Three important features of the Orbit Forged Steel Venturi Valve design are:

1. *The tapered sections are smoothly machined and are gradual so as to eliminate serious frictional losses.*
2. *The diverging conical downstream passage reduces pressure drops to a minimum.*
3. *The entrance and exit walls of the conical sections are held at minimum angles.*

Orbit Venturi Valves are compact in design yet are built for continuous heavy duty service.

Available in flanged end only, ASA Class, Carbon Trim, Stainless Trim, Sizes: 2″, 2½″, 3″, 4″ and 6″, beginning with 150 Lb. Class.

Available also in Full Round Opening ASA Class, Sizes: 1″, 1½″ 2″, 2½″, 3″, 4″, beginning with ASA 300 Lb. Class. Screw and Flanged Ends.

ORBIT VALVES ®

ORBIT VALVE COMPANY

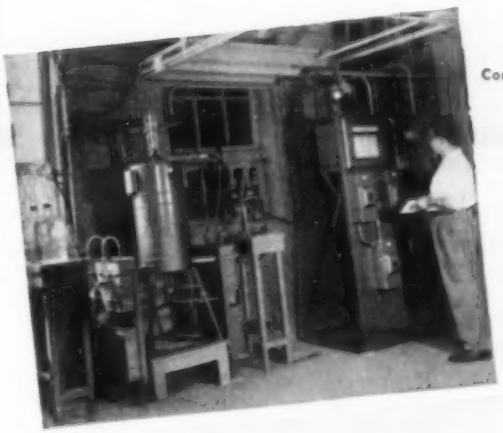
P. O. BOX 699 TULSA, OKLAHOMA

If you use . . . or plan to use

HIGH-ALUMINA
CRACKING CATALYST

Specify

Nalcat **HA-1 or HA-2**



Continuous quality control and research progress are the products of Nalco Catalyst Division Laboratories.

● If you are exploring the possibilities of high-alumina catalyst for your cracking operations, check on Nalcat HA-1 and HA-2 for research and production use. These high-alumina formulas are available in whatever quantities you require, promptly . . . as a part of the Nalco policy of *Service* to the Petroleum Industry.

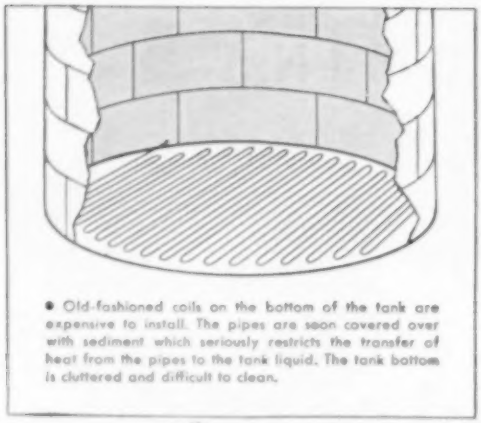
Nalcat® *Nalform*

Production and Service to Match Petroleum Industry Progress

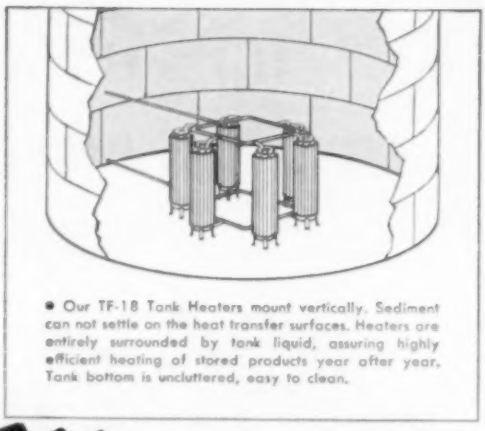
CATALYST DIVISION
NATIONAL ALUMINATE CORPORATION
4003 West 71st Street, Chicago 29, Illinois

BROWN FINTUBE'S

BETTER DESIGN MEANS BETTER PERFORMANCE



• Old-fashioned coils on the bottom of the tank are expensive to install. The pipes are soon covered over with sediment which seriously restricts the transfer of heat from the pipes to the tank liquid. The tank bottom is cluttered and difficult to clean.



• Our TF-18 Tank Heaters mount vertically. Sediment can not settle on the heat transfer surfaces. Heaters are entirely surrounded by tank liquid, assuring highly efficient heating of stored products year after year. Tank bottom is uncluttered, easy to clean.

Vertical Mounting

of BROWN FINTUBE TF-18 TANK HEATERS

assures more efficient, less costly heating of stored products

Our TF-18 vertically mounted tank heaters have obsoleted old-fashioned tank coils — and give users four outstanding advantages:—

1) **Lower Cost**—Users report that the cost of our TF-18 Heaters *plus* their installation is usually ***less than the cost of just installing*** bare pipe coils of equivalent capacity.

2) **Vertical Mounting** — on legs about 10" above the tank floor brings the entire heating surface in contact with the stored product — avoids heating through a layer of sediment.

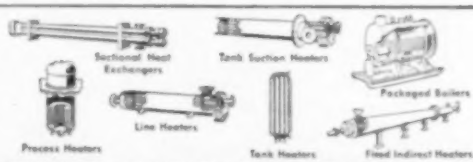
3) **Increased Heating Efficiency** — the finned construction provides about 7 times more heating surface per foot of lineal length than plain bare pipe. This permits more heat to be transferred — faster — at lower temperatures per square foot of surface, avoiding coking or damage to heat sensitive products. Mild steel or alloy construction.

4) **Easy Installation** — TF-18 Heaters pass through a standard manhole permitting easy installation in new or existing tanks. Can be flange connected when desired and thus do not require welding inside the tank. Individually trapped, or manifolded inside or outside the tank.

You can't keep your operations competitive with old-fashioned, obsolete methods. Write today for Bulletin 541. It gives full details, dimensions, etc., about our fully proved, less costly TF-18 Heaters. Tested, and widely used by many of the best known, most progressive, lowest cost companies in the industry. Write for Bul. No. 541 ***today!***

BROWN FINTUBE CO.

375 HURON ST., *Elyria, Ohio*



Engineering and Sales Representatives: NEW YORK • BOSTON • PHILADELPHIA • PITTSBURGH • BUFFALO • CLEVELAND • CINCINNATI DETROIT • CHICAGO • ST. PAUL • ST. LOUIS • KANSAS CITY • MEMPHIS • BIRMINGHAM • NEW ORLEANS • SHREVEPORT • TULSA • HOUSTON • DALLAS DENVER • LOS ANGELES AND SAN FRANCISCO ● *Licensed Manufacturers:* BROWN FINTUBE (CANADA) LTD., ST. THOMAS, ONTARIO, CANADA BROWN FINTUBE (GREAT BRITAIN) LTD., BIRMINGHAM, ENGLAND • FRIEDRICH UHDE, GMBH, DORTMUND, GERMANY

HUDSON Solo-aire and Combin-aire COOLING UNITS

minimize water consumption in the Pegasus Plant of Magnolia Petroleum Company, Midland County, West Texas

Pictured in the foreground is the HUDSON Combin-aire unit, with Solo-aire units in the background. Air is used directly for cooling in the Solo-aires where low temperatures are not required. The Combin-aire uses a small quantity of water to precool the air so that entering hot fluids may be cooled to effluent temperatures lower than those obtainable by direct use of air.

If the total heat load of this plant had been dissipated thru a conventional cooling tower, 158 million gallons of water per year would have been required for makeup. The actual annual water makeup for the plant is only 17 million gallons per year. In this plant the use of the Solo-aire and Combin-aire have proven advantageous, resulting in savings in first cost, in operating costs for horsepower, water treating, and maintenance, and in obviating necessity for drilling of several water wells. Savings in cost of piping result thru installing the Combin-aire in close proximity to process equipment, made possible because the effluent high temperature air is always under-saturated with water vapor and nuisance and high maintenance cost due to water carryover or condensation are eliminated.

New bulletin
"Cooling with Air"
mailed upon request

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

Accurate, Automatic Temperature Control

Hudson Solo-aire or Combin-aire units, or water cooling towers may be equipped with Auto-Variable pitch fans. Minute changes in cooled fluid outlet temperature immediately and automatically changes pitch of fan blades increasing or decreasing air flow. Control is effective despite changes in heat load or hot fluid inlet temperature; and over ambient air temperature range of more than 150° F.

Compared with fixed-pitch fans, Hudson Auto-Variable fans effect power *savings* of as much as 85%, depending upon actual versus design air temperatures.

Hundreds of auto-variable pitch fans from 6 to 18 feet in diameter are providing accurate, trouble-free, temperature control without necessity for shutters, louvers or by-passes, and with large power savings.

HUDSON AUTO-VARIABLE PITCH FANS

- **Accurately control temperature.**
- **Effect major savings in power.**
- **Reduce cost of control equipment.**
- **Eliminate by-pass piping.**
- **Prevent freezing even in extremely cold weather.**
- **Operate with standard pneumatic instruments.**
- **Have all moving parts of control mechanism completely enclosed and weather-proofed.**

Hudson designs and manufactures cooling systems using water exclusively, air exclusively, and combinations of air and water. Objective comparisons are furnished without cost.

Hudson Auto-Variable Pitch Fan is protected by U. S. patents and patents pending.

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

BETZ• *A Great Name*
In Water Conditioning

Engineer at work!

If you were to walk into the Engineering Department of our Philadelphia headquarters, chances are you'd see a vacant desk or two like this. And for good reason!

The engineer who occupies this desk might be in Maine, California, Texas . . . anywhere in the country providing supplemental assistance on water problems . . . helping your *personal* representative, the Betz District Engineer and *you* to do a better job in your plant.

He's one of a group of over 20 Betz specialists that make up our fully-staffed Engineering Department . . . providing *additional* headquarters engineering support as well as in-the-field engineering as required.

It is the responsibility of the Betz Engineering Department to carefully analyze the many facets of information concerning your water problems . . . to engineer, interpret, and diagnose the situation as it exists in your plant . . . and to work with the Betz District Engineer to recommend the correct steps to overcome the difficulty.

This *complete* engineering service is another reason why Betz *continues* its leadership in providing sound engineering on all water problems. It will pay you to talk with a Betz District Engineer today. No obligation, of course.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa.

In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

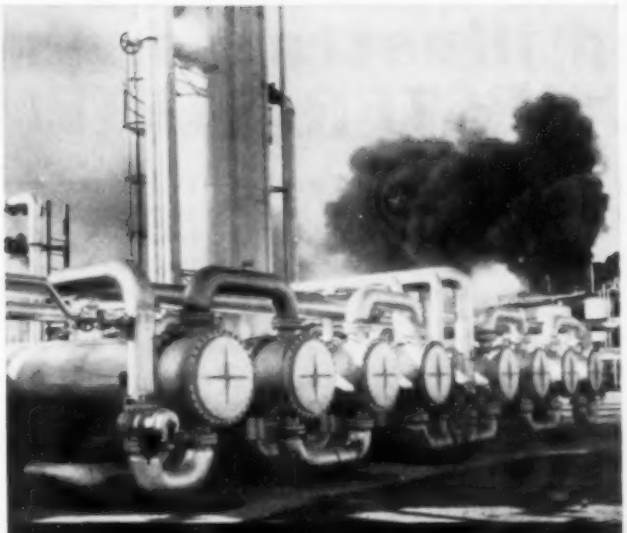
CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

CATFORMING *means*

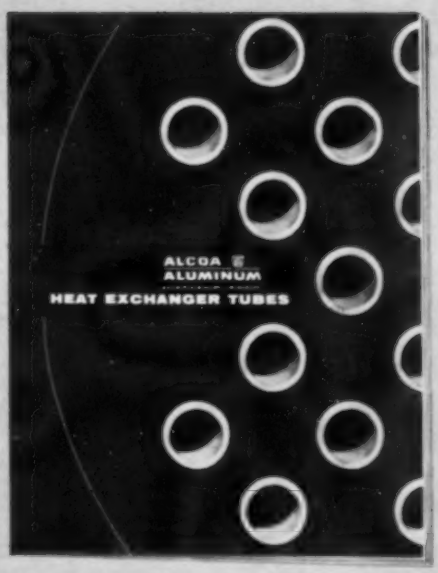
High Octanes...
High Yields...
Low Cost...
Proved Performance

These advantages of Atlantic Catforming are being demonstrated again and again in different commercial installations. We invite you to share in the benefits of Catforming. Please phone, write or wire for our detailed brochure, "CATFORMING." The Atlantic Refining Company, Research and Development Dept., P. O. Box 8138, Philadelphia, Pa.

ATLANTIC *It's the Catalyst that counts*



Send for new, free booklet
on cost cutting
ALCOA ALUMINUM HEAT EXCHANGER TUBES



Just off the presses, this booklet brings you all the facts about the latest developments in aluminum heat exchanger tubes. Profusely illustrated with photos, charts and graphs. Provides specifications and estimating data that are the result of ALCOA's more than 30 years' experience with aluminum tubes for condensers and heat exchangers.

TABLE OF CONTENTS

Why Alcoa Aluminum Heat Exchanger Tubes?
Types of Alcoa Heat Exchanger Tubes
What is Alclad?
Effect of Cooling Waters
Cathodic Protection
Tube Cleaning
Water Treatment
Application of Aluminum Heat Exchanger Tubes
Typical Commodities Processed
Aluminum Is Well Suited for Heat Exchanger Fabrication
Heat Transfer Characteristics
Physical Constants
Fluid Flow Characteristics
Specifications and Data
Estimating Data
Allowable Internal Working Pressures
Allowable External Working Pressures
Typical Tensile Properties of Aluminum Alloys
Nominal Composition of Wrought Aluminum Alloys

The general acceptance of aluminum heat exchanger tubes by the process industries has come about for several reasons—the excellent properties of aluminum alloys, ALCOA'S cooperative research and development programs aimed at establishing sound applications, and industry's desire for a good product at an economical price.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

ALUMINUM COMPANY OF AMERICA
1000 D Alcoa Building, Pittsburgh 19, Pa.
Please send me a copy of your new, free booklet, *Alcoa Aluminum Heat Exchanger Tubes*.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

(To obtain more data on advertised products see page 564)

Briefly, this ad illustrates why DEMPSTER-DUMPSTER SYSTEM

Container at right has cast iron bottom and inside walls are lined with fire brick. It handles hot skim off aluminum.

This Tilt Type Container was the result of a cost-cutting idea whereby a high temperature dusty product would be handled by a plant's Dempster-Dumpster. Container has cooling fins, counter-balanced hinged lid with 3-way locking device, 16" sliding gate valve and two sight-glass inspection openings.

Here is a Hopper Type Container with a top door for filling and two bottom discharge doors operated by rack and pinion. Another case where the Dempster-Dumpster System was applied to an additional problem to further reduce costs.

Container at right is just one of several different types we have designed to handle equipment, materials, packages, parcels, etc.

IN A NORMAL INSTALLATION the Dempster-Dumpster System is purchased by a plant because of its proved record for handling bulk materials at tremendous savings. This normal installation usually includes one truck mounted Dempster-Dumpster and any number of standard containers designed to meet the various requirements within the plant. In some cases, containers number 40 to 50. These containers can range in capacity up to 21 cu. yds., with all containers served by the one Dempster-Dumpster.

In the great majority of cases this basic installation is just a starter. Management men, constantly looking for lower operating costs, find numerous and amazing extra savings in the Dempster-Dumpster System. Once in service, transporting developments of every description come to light that supplement the original functions of the equipment. Your own men find easier, quicker and additional cost saving ideas for its use. Many even overshadow the original savings and the equipment becomes more and more indispensable.

Look over just a few of the "Special" containers illustrated in this ad. They are all the result of rough ideas that originated with the men in plants after a basic installation, then developed by our engineers. All ideas were stimulated by the powerful Dempster-Dumpster and its flexibility in picking up, hauling, setting down or dumping anything that needs transporting, at lower cost.

One man, the driver, and a few simple hydraulic controls in the cab of a Dempster-Dumpster, will become indispensable in your plant. It is just that in hundreds of plants of every description throughout the nation. Let one of our representatives give you details of installations. Manufactured exclusively by Dempster Brothers, Inc.

Above container is built with cast iron liner. The holes in outer wall are for cooling.

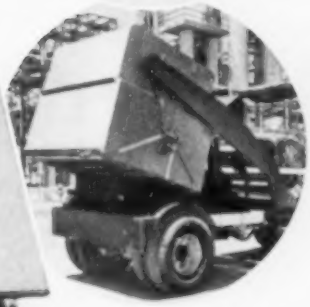
Here is one of several special drop bottom type containers equipped with couplers and ball bearing trucks for operation in train on rails.

THE DEMPSTER-DUMPSTER SYSTEM

DEMPSTER BROTHERS

(To obtain more data on advertised products see page 564)

so many plants find the indispensable...



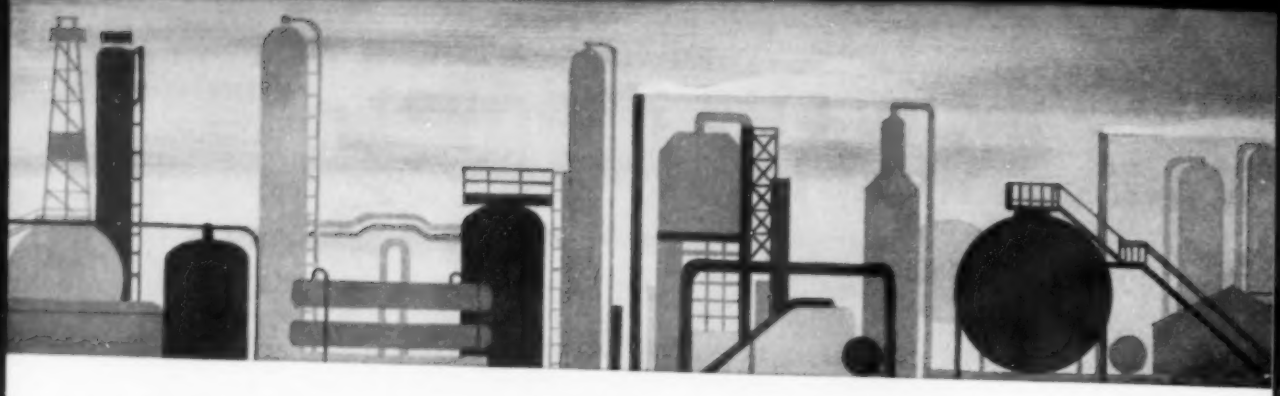
Two photos above show how all containers, regardless of design, are picked up and hauled. At destination materials are dumped from drop bottom containers as shown at left . . . from Tilt and Skip Type Containers by tilting. Any load, of course, may be set down intact.

This is a special adaptation whereby waste zinc slurry is pumped into two containers, which serve as settling tanks, enabling majority of the water to be decanted before sludge is transported and dumped at waste basin.

Tank Type Containers are available with or without casters in steel, aluminum, stainless steel, etc. Capacity ranges up to 1,200 gal. They may be lined with rubber, lead, highly resistance coatings, etc.

This is a master container with three 2 cu. yd. insert containers. Each insert container is provided with casters, counter-balanced spring-hinged lid for loading and dumping.

545 DEMPSTER BLDG., KNOXVILLE 17, TENNESSEE

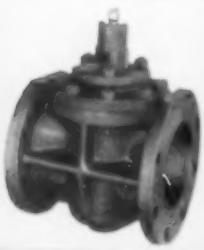


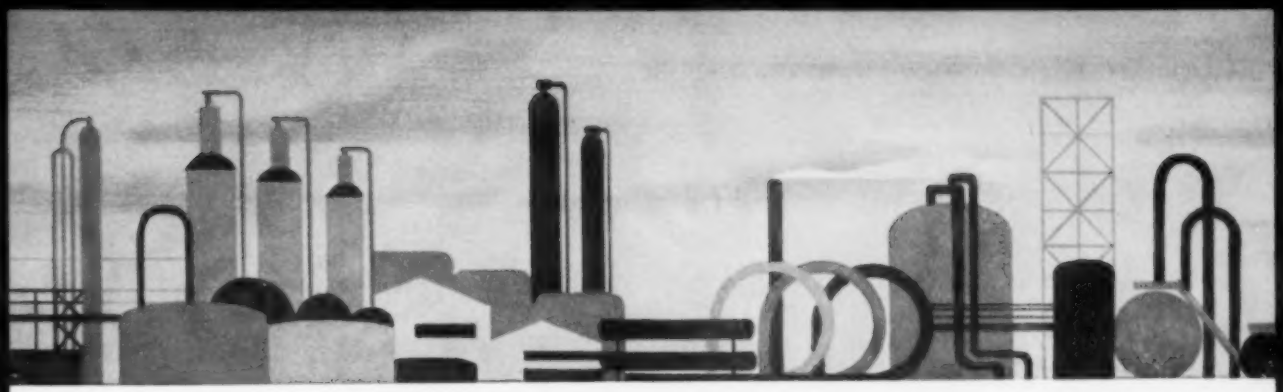
Where It PAYS To Use

REFINERY VALVE CHECK LIST

Where To Use ROCKWELL-NORDSTROM Valves

- ☑ Crude Lines To Refinery
- ☑ Heater Lines
- ☑ Towers
- ☑ Relief Valve Settings
- ☑ Lube Oil Treating
- ☑ Blending Lines
- ☑ Dewaxing
- ☑ Filtering
- ☑ Transfer Lines
- ☑ Solvent Extraction
- ☑ Products Lines
- ☑ Tank Farms
- ☑ Loading Racks
- ☑ Fuel and Supply Lines
- ☑ Cat Crackers
- ☑ Platforming Units





Rockwell-Nordstrom Valves

For The Most Economical, Trouble-Free Refinery Valve Service

Look very carefully at the refinery valve check list on the left. If you are not now using Rockwell-Nordstrom valves at these important points, you have a real opportunity to make worth-while savings through longer, more trouble-free valve life, and lower repair, replacement and down time costs. Here are the reasons:

ECONOMICAL: Rockwell-Nordstrom valves are the most economical refinery valves you can use. Pressurized lubrication—which forms the time-proven leakproof seal—also eliminates metal-to-metal friction and "armor plates" the working parts against corrosive or erosive line material. And the valve seats, the parts that are "eaten out" fastest on ordinary valves, are *never* exposed to line material.

Rockwell-Nordstrom valves will start saving money for you the day they go on-stream because lubrication and rugged design eliminate costly repair and replacement and assure longer economic valve life.

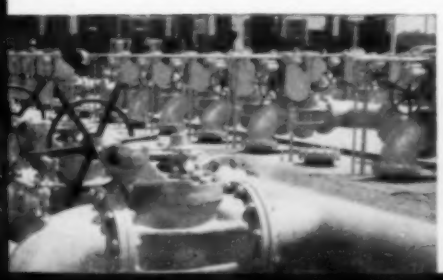
TROUBLE-FREE: Refinery engineers have been standardizing on Rockwell-Nordstrom valves for forty years. They've learned that the pressurized lubricant seal and positive shut-off assure *safe*, leakproof operation in *any* refinery service. Refinery operations men prefer Rockwell-Nordstrom valves because quarter turn closure permits accurate, smooth flow control. There are no bulky, large open cavities on Rockwell-Nordstrom valves; they require less space in manifolds. "Open-Close" guess work is eliminated—a glance at the wrench instantly tells plug position.

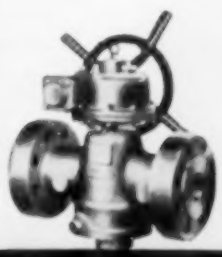
Rockwell-Nordstrom valves are available in *the only complete range* of lubricated plug valve sizes and pressure-temperature ratings in steel, semi-steel and corrosion resisting alloy patterns. Write for complete information today: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

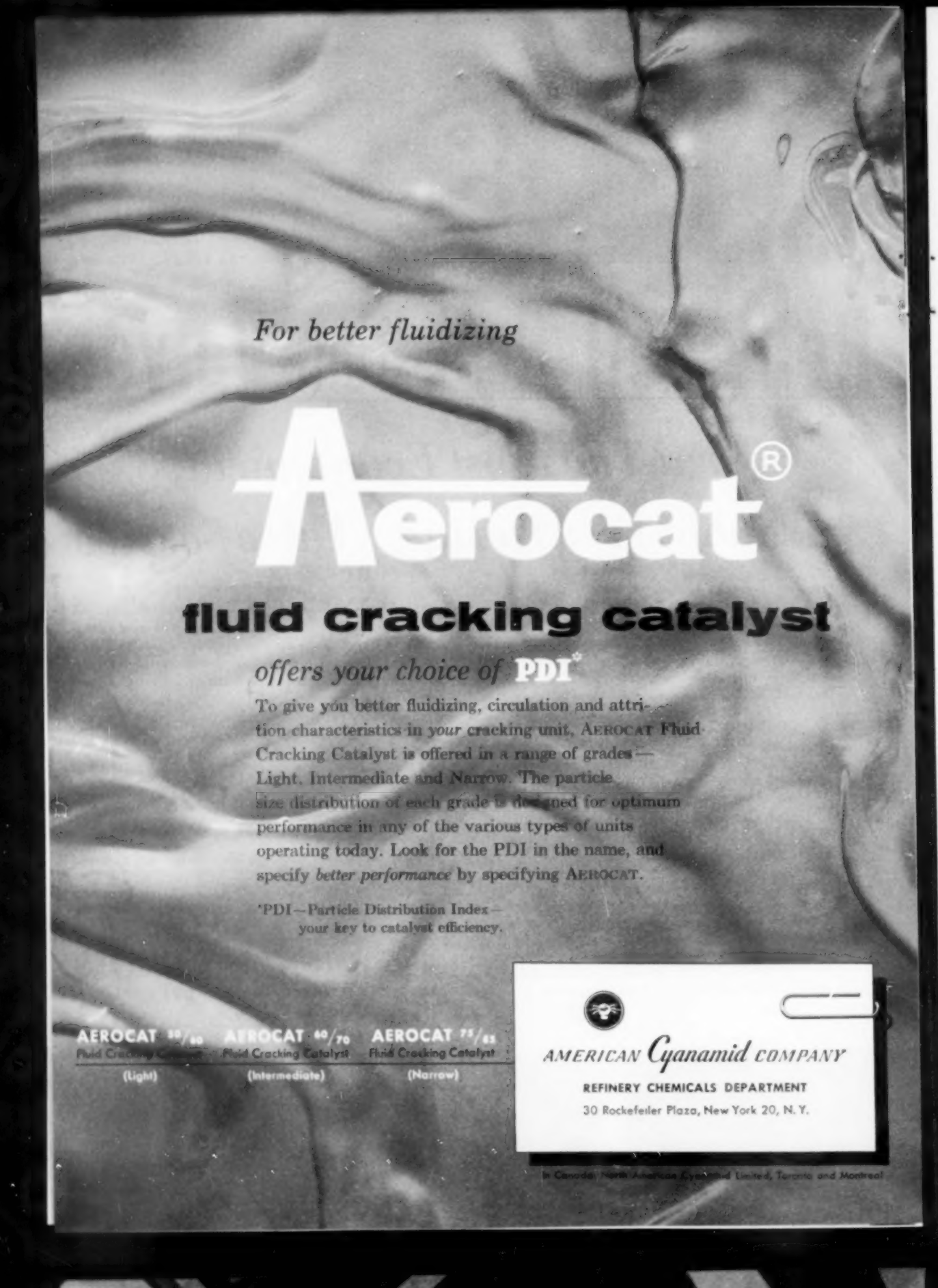
Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF






For better fluidizing
Aerocat®
fluid cracking catalyst
offers your choice of PDI*
To give you better fluidizing, circulation and attrition characteristics in your cracking unit, AEROCAT Fluid Cracking Catalyst is offered in a range of grades — Light, Intermediate and Narrow. The particle size distribution of each grade is designed for optimum performance in any of the various types of units operating today. Look for the PDI in the name, and specify better performance by specifying AEROCAT.
*PDI—Particle Distribution Index — your key to catalyst efficiency.
AEROCAT 55/60 Fluid Cracking Catalyst (Light)
AEROCAT 60/70 Fluid Cracking Catalyst (Intermediate)
AEROCAT 75/85 Fluid Cracking Catalyst (Narrow)
AMERICAN Cyanamid COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.
In Canada: North American Cyanamid Limited, Toronto and Montreal

to all NATURAL GASOLINE MEN
GREETINGS

from the

NATURAL GASOLINE SUPPLY MEN'S ASSOCIATION

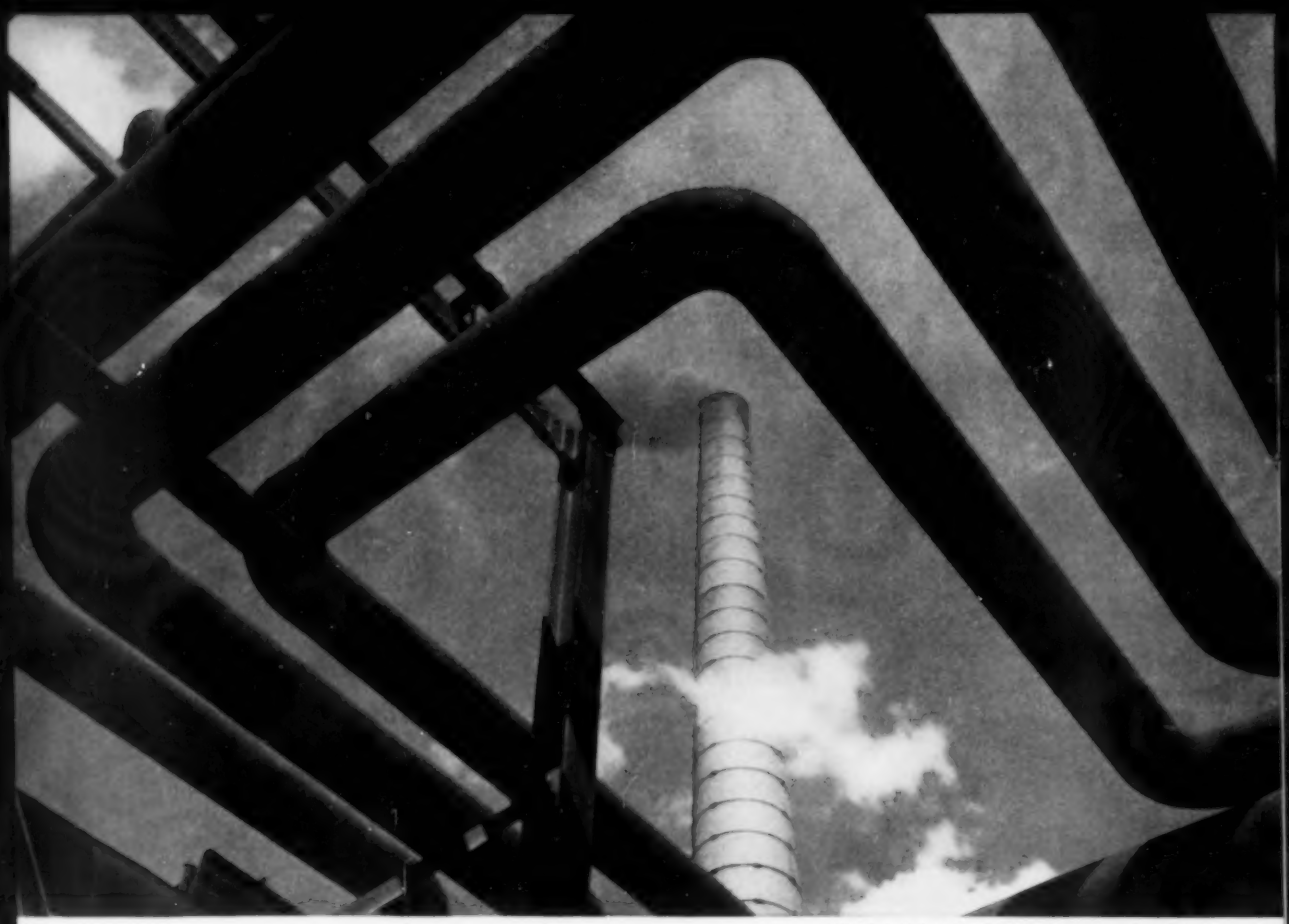
We are looking forward to seeing you at the

THIRTY-FOURTH ANNUAL CONVENTION
of the NATURAL GASOLINE ASSOCIATION of AMERICA
APRIL 13-15, BAKER AND ADOLPHUS HOTELS,
Dallas, Texas

Members of the Natural Gasoline Supply Men's Association:

The Aber Company
M. N. Aitken Company
Alliger and Sears Co.
Allis-Chalmers Mfg. Co.
Aluminum Company of America
American Air Filter Co., Inc.
American Locomotive Co.
American Meter Co., Inc.
Ansul Chemical Company
Aquatrol, Inc.
Armco Drainage and Metal Products, Inc.
Arrow Industrial Mfg. Co.
J. B. Beaird Company, Inc.
Bellco Industrial Engineering Co.
The Belmas Company, Inc.
Berry Div.—Oliver Iron & Steel Corp.
Bethlehem Supply Company
W. H. & L. D. Betz
The Bird-Archer Company
Black, Sivalls & Bryson, Inc.
Blaw-Knox Company—Chemical Plts. Div.
Born Engineering Co.
Bowden Construction Co., Inc.
Braden Steel Corp.
U. J. Brammer & Sons
C. F. Braun & Company
Briggs Filtration Co.
Brown Fintube Company
Brown and Root, Inc.
Burgess-Manning Co.
Butane-Propane News
Byron Jackson Company
Cameron Iron Works, Inc.
Chicago Bridge and Iron Co.
Clark Bros. Co., Inc.
Clowe & Cowan, Inc.
The Condit Company
Continental Products Corp.
Continental Supply Company
C. Lee Cook Mfg. Co.
Cooling Tower Service, Div.—Santa Fe Tank and Tower Co. of Texas
The Cooper-Bessemer Corp.
Joseph A. Coy Company, Inc.
Crane Packing Company
W. H. Curtin and Company
Dallas Tank Company, Inc.
Daniel Orifice Fitting Company
Davison Chemical Co.
Davis Regulator Company
Dearborn Chemical Company
De Laval Steam Turbine Company
Delta Engineering Corp.
M. H. Detrick Company
Dresser Engineering Company
E. I. duPont deNemours and Co., Inc.
Eggelhof Engineers
John W. Elder Company
Elliott Company
Engine Life Products Corp.
Engineering Equipment Co.
Engineers and Fabricators, Inc.
Ethyl Corporation
The Fisher Governor Company
Flint Steel Corporation
Flow Measurement Co.
The Fluor Corp. Ltd.
The Foxboro Company
France Packing Company
Franklin Supply Company
The Garlock Packing Company
Gasoline Plant Construction Corp.
General Electric Co.
J. B. Gill Company
Goulds Pumps, Inc.
Graver Tank & Mfg. Co., Inc.
Greene Brothers, Inc.
The Griscom-Russell Co.
Grove Valve & Regulator Co.
D. W. Haering and Co., Inc.
The Happy Company
Hercules-Lupfer Engine Sales Co.
The Hilliard Corporation
Hudson Engineering Corp.
Huffman & Pierce Construction Co.
Industrial Scientific, Inc.
Infilco, Inc.
Ingersoll-Rand Co.
Johns-Manville Sales Corp.
Kansas Paint and Color Company
The M. W. Kellogg Company
The Koch Engineering Co.
James S. Kone & Company
Ladish Company
Le Roi Company
Warner Lewis Company
A. M. Lockett and Co., Ltd.
The Lubricosos Specialties Mfg. Co.
The Lunkenheimer Co.
Maintenance Engineering Corp.
F. H. Maloney Company
Manco Engineering Co.
Manning, Maxwell and Moore
Manzel
Steve C. Maples Div., Allan Edwards Mfg. Co., Inc.
Market Development Div.,—Phillips Petroleum Co.
The Marley Company, Inc.
Chas. Martin & Company
Marsh Instrument & Valve Co.
C. A. Mathey Machine Works
Lynn McGuffy Company
J. R. Meek Company
Metal Goods Corporation
Mid-Continent Supply Company
Minneapolis-Honeywell Regulator Co.
Moorlane Company
Moran Furnace and Sheet Metal Co.
National Petroleum News
The National Supply Company
National Tank Company
Naylor Pipe Company
Newman's, Inc.
Nickles Machine Co.
Nordstrom Valve Div.,—Rockwell Mfg. Co.
Wm. W. Nugent & Co., Inc.
Nutter Engineering Co.
The Oil and Gas Journal
The Oil Daily
Oil Well Supply Div.,—U. S. Steel Corp.
O. L. Olsen
Orbit Valve Company
Pacific Pumps, Inc.
Paramount Supply Co.
Peerless Mfg. Co.
Perry Equipment Corp.
Petro-Chem Development Co., Inc.
The Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Pittsburgh Equitable Meter Div. Rockwell Mfg. Co.
Plibrico Company
Podbielniak, Inc.
Power Machinery Co.
Power Specialty Co.
J. F. Pritchard and Co.
Process Equipment Co.
Puffer-Sweiven Company
The Refinery Supply Co.
Republic Supply Co.
Riddle and Hubbell
Robinson Orifice Fitting Co.
Rockwood Sprinkler Company
E. W. Saybolt and Company
A. O. Smith Corporation
Snyder Co., Inc.
Southern Engine & Pump Co.
Stearns-Roger Mfg. Co.
Stentz Equipment Co.
Stitt Ignition Co.
Superior Mfg. Co.
Taylor Forge and Pipe Works
Taylor Instrument Companies
Tellepsen Construction Co.
The Tennant Co.
Tube Turns Div.,—National Cylinder Gas Co.
Tuloma Builders, Inc.
Tyler-Dawson Supply Co.
Union Steam Pump Sales Company
United Centrifugal Pumps
United Chemical Corp.
Vinson Chemical Corp.
Vulcan Steel Tank Corp.
Walco Engineering & Constr. Co.
Walworth Company
Well Equipment Mfg. Corp.
Westcott & Greis, Inc.
Western Chemical Co., of Kansas City, Mo.
Western Chemical & Supply Co.
Western Supply Co.
The Wickes Boiler Co.
Woobank Machinery Co.
World Petroleum
Worthington Corp.
Wright Chemical Corp.
Wyatt Metal and Boiler Works
Young Sales Corp.
John Zink Burner Company

(To obtain more data on advertised products see page 564)



"Worm's eye" view of live and exhaust steam lines protected with Carey insulation at Gulf's Port Arthur, Texas refinery.

25th Anniversary of tough Texas service at Gulf

...Carey Magnesia Insulations defy vibration, humidity, heat!

Continuous outdoor service for 25 years! That's the record set by Carey magnesia insulation at Gulf Oil Corporation's big refinery, Port Arthur, Texas. And here, service conditions are *really* rugged. Besides the unmerciful vibration, expansion and contraction present in every refinery operation, you have blazing sun, high winds, heavy rains and corrosive salt air!

Carey's experience in development and manufacture of insulation products since 1873 is *one* big reason why Carey insulations are so outstanding. And it's the reason, too, why we believe we can help you solve your heat insulation problems, unusual though they may be.

The Carey line includes insulation for sub-zero to 2500° F service. Major products are Super-Light 85% Magnesia and Tempchek in precision-sized blocks and nesting "O. D." pipe coverings; blankets; pipe wrapping and jackets; cements. All excel in ease of application; are economical to use. Ask your Carey Industrial Sales Engineer for helpful advice.

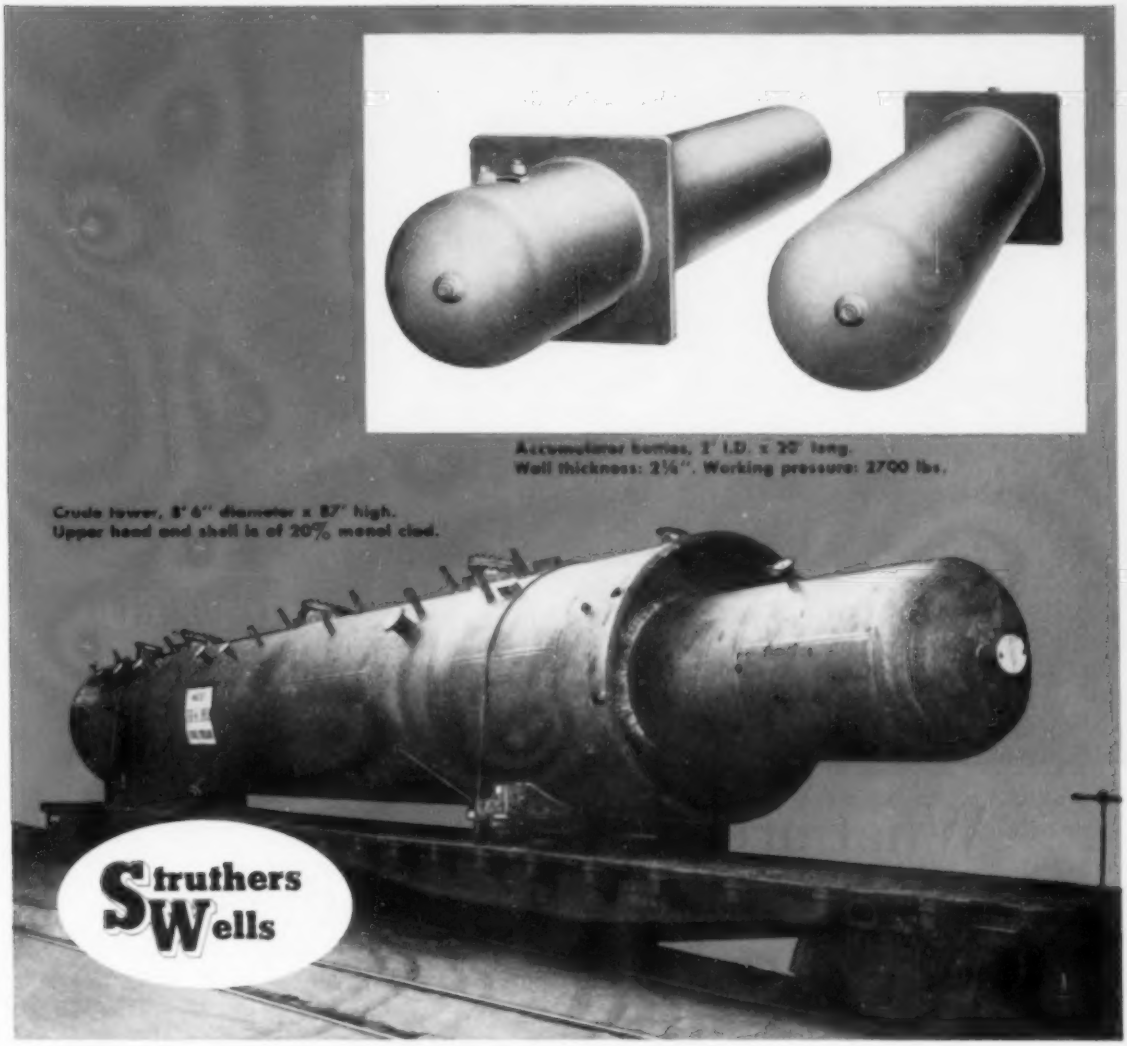
Write for your free copy of catalog giving complete technical and application data. Address Dept. PP-4.

Quality Products for Industry, Farm and Home Since 1873

Carey Industrial Insulation

THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio
In Canada: The Philip Carey Co., Ltd., Montreal 3, P. Q.

Carey-approved contract units in major trading areas. Consult your nearest Carey District Office or your telephone directory.


Accumulator bottles, 1' I.D. x 20' long.
Wall thickness: 2¼". Working pressure: 2700 lbs.
Crude tower, 8' 6" diameter x 87' high.
Upper head and shell is of 20% monel clad.
Struthers Wells

DEPENDABLE PROCESSING PERFORMANCE IS ASSURED

...when Equipment is Designed and Fabricated by Struthers Wells

Process equipment such as that illustrated above constantly rolls out of our modern, efficient plants—to meet the exacting specifications and delivery requirements of valued customers in the chemical and petroleum processing industries. Intensive experience in the design and fabrication of standard or specialized processing equipment—regardless of size, specifications or codes—has built an enviable reputation for us in the construction of highest quality products that provide service of utmost satisfaction. Yes . . . in choosing Struthers Wells as your process equipment fabricator—efficient, safe, economical and long life performance is assured.

Struthers Wells

STRUTHERS WELLS
CORPORATION
TITUSVILLE, PA.
Plants at Titusville and Warren, Pa.
Offices in principal cities

(To obtain more data on advertised products see page 564)

℞ SPHERES
Diameters from 3/16" to 1"
℞ RINGS
Sizes from 1/32" I.D. x 3/16" long x 1/32" O.D. to 1/2" I.D. x 1" long x 1" O.D.
℞ PELLETS
Sizes from 1/8" x 1/8" to 1/2" x 1/2"

What are your catalyst carrier applications?

Norton engineered and prescribed carriers offer you important processing advantages

What do you need? An inert, high alumina carrier for fixed bed oxidation reactions — such as those involved in the manufacture of phthalic anhydride, maleic anhydride and ethylene oxide?

An inert, low density carrier for use as a space filler or tower packing?

Norton ALUNDUM* fused alpha alumina carriers are proving highly successful in such processes. Containing 77% to 89% alumina, they are outstanding for chemical stability and resistance to abrasion and erosion — and their low density is a valuable quality in packing and filling applications.

ALUNDUM carriers are commercially available in the form of spheres, rings and pellets. Also available in experimental quantities are carriers made of MAGNORITE*, CRYSTOLON*, Fused Stabilized Zirconia and Kyanite materials.

ALUNDUM Spherical Carriers

provide uniform beds in catalytic converters, reducing channeling and pressure drop to a minimum. Medium porosity spheres (40%-44%) have a network of open pores on the outside surface only. These are specifically recommended for applications where the carrier is coated with a catalyst. High porosity spheres (45%-49%) have an internal as well as external network of pores, and are suitable for applications where the carrier is impregnated with a catalyst.

Other Norton Refractories

for chemical processing include porous mediums, laboratory ware, ALUNDUM, MAGNORITE, CRYSTOLON, and Fused Stabilized Zirconia shapes. All are *engineered and prescribed* to give you the best possible ℞ — the most effective combination of physical characteristics plus thermal, chemical and electrical properties. For details call in your Norton Refractories Engineer, or write, mentioning your specific requirements to NORTON COMPANY, 263 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Canada.

NORTON

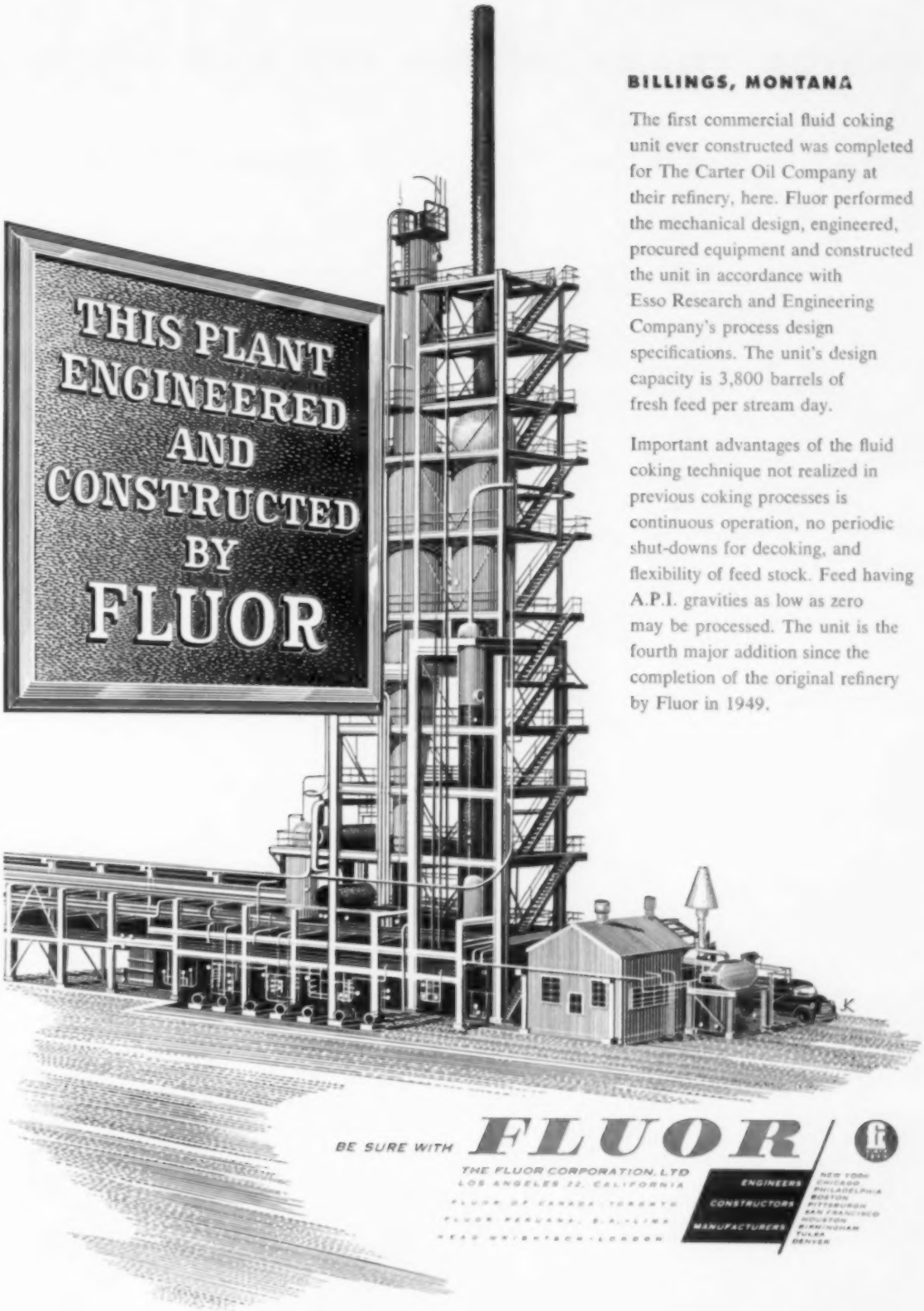
REFRACTORIES

Engineered... ℞ ... Prescribed

Making better products... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

(To obtain more data on advertised products see page 564)



BILLINGS, MONTANA

The first commercial fluid coking unit ever constructed was completed for The Carter Oil Company at their refinery, here. Fluor performed the mechanical design, engineered, procured equipment and constructed the unit in accordance with Esso Research and Engineering Company's process design specifications. The unit's design capacity is 3,800 barrels of fresh feed per stream day.

Important advantages of the fluid coking technique not realized in previous coking processes is continuous operation, no periodic shut-downs for decoking, and flexibility of feed stock. Feed having A.P.I. gravities as low as zero may be processed. The unit is the fourth major addition since the completion of the original refinery by Fluor in 1949.

BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD
LOS ANGELES 22, CALIFORNIA

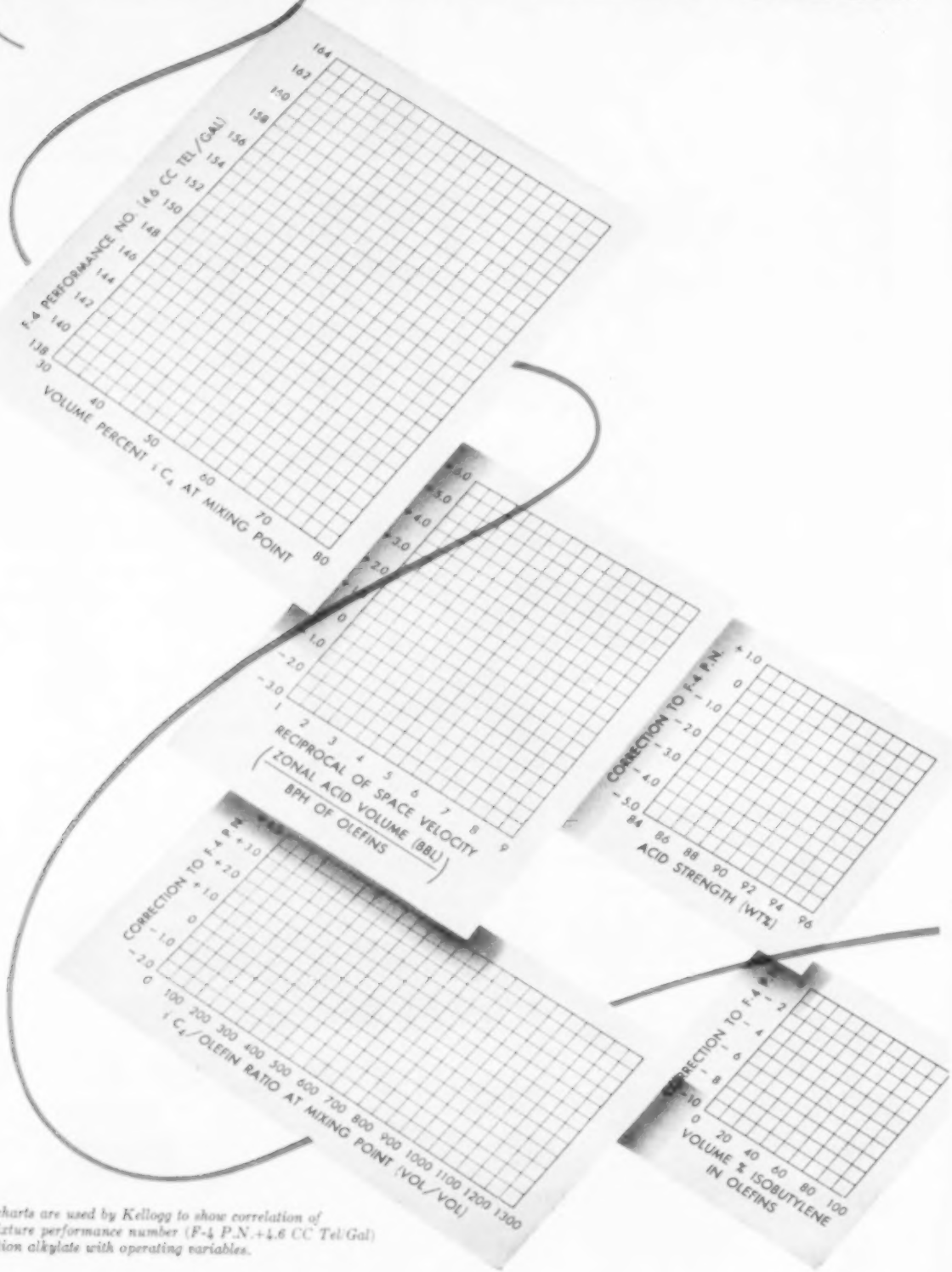
FLUOR OF CANADA, TORONTO
FLUOR PERUANA, S.A., LIMA
HEAD WRIGHTSON, LONDON

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA
DENVER

(To obtain more data on advertised products see page 564)

INSIDE TRACK IN THE OCTANE RACE...


F-4 PERFORMANCE NO. (4.6 CC TEL/GAL)
VOLUME PERCENT i C4 AT MIXING POINT
RECIPROCAL OF SPACE VELOCITY
(ZONAL ACID VOLUME (BBL)
BPH OF OLEFINS)
CORRECTION TO F-4 P.N.
ACID STRENGTH (WT%)
CORRECTION TO F-4 P.N.
i C4/OLEFIN RATIO AT MIXING POINT (VOL/VOL)
CORRECTION TO F-4
VOLUME % ISOBUTYLENE
IN OLEFINS

These charts are used by Kellogg to show correlation of rich mixture performance number (F-4 P.N.+4.6 CC Tel/Gal) of aviation alkylate with operating variables.

(To obtain more data on advertised products see page 564)

Kellogg Alkylation

-INVESTMENT PAYOUT IN ONE YEAR!

A quick way to higher octane ratings at lowest operating and investment costs is sulfuric acid alkylation—utilizing Kellogg's unique cascade reactor and auto-refrigeration system.

Providing exceptionally high yields of superior alkylate, this Kellogg process sharply reduces the cost of the isobutane recycling equipment; maintains acid consumption at the lowest possible level; assures efficient mixing in reaction sections at low horsepower.

The accompanying co-ordinates demonstrate a few of the variables confronting the alkylate process engineer. The curves of these co-ordinates have been worked out through Kellogg research and experience, and the design results are available to refiners planning new alkylate capacity.

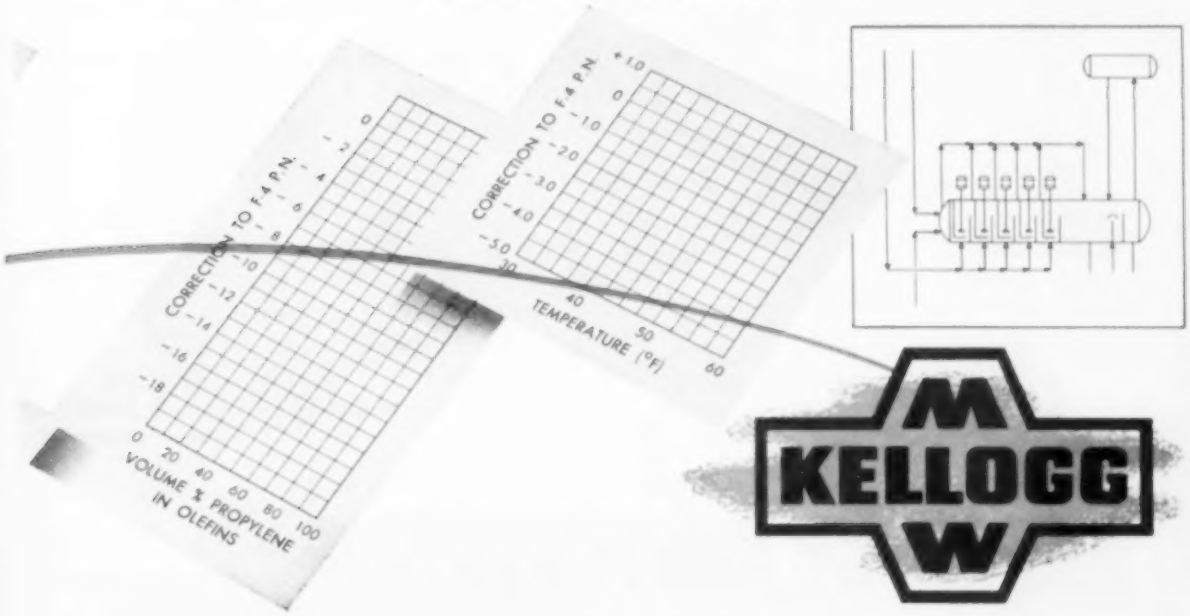
An example of what Kellogg alkylation can do in attaining premium results working with various blending components is provided by a recent study undertaken by Kellogg engineers of a proposed new 25,000 BPSD refinery on the Gulf Coast. Here, alkylation of total C_3 and C_4 olefins, assuming extraneous isobutane available at nominal price, results in the production of 15 volume percent on crude of high octane alkylate, with a payout on incremental investment over a base case of well under one year.

A comparable study of incremental alkylation not requiring extraneous isobutane, but compared with a base case incorporating non-selective catalytic polymerization, shows a payout of just over a year. Under these conditions alkylate production amounts to 6 volume percent on crude, and the combined alkylate plus catalytic polymer to slightly over 9 volume percent.

REFINERY PROCESS DIVISION, THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.

In Canada: The Canadian Kellogg Company, Limited, Toronto. In Europe: Kellogg International Corporation, London

SUBSIDIARIES OF PULLMAN INCORPORATED



THE MEN BEHIND TRECO

TRECO

T. M. LUMLY
President

D. O. GIVENS
Vice President

H. BOTTOMLEY
Process Engineer

D. F. FERGUSON
Process Engineer

H. V. FLEMMING
Sales Manager

P. A. KAHLE
Vice President

H. F. KOONS
Project Engineer

P. M. SOWERS
Director of Purchases

K. T. WALKER
Chief Engineer

You've probably met one or more of these men in your contacts in the refinery industry. They've done just about every job in refineries prior to their engineering-construction careers.

When a plant is designed by these men and their associates, you know it will produce as planned. You can rest assured that not even the smallest detail will be overlooked and that it will be completed on time.

Whether you require a new refinery or to revamp existing facilities, it will pay you to talk with TRECO before you make any plans. TRECO has the man power, the equipment and company aircraft to complete your job *FAST*.

In Canada — 2 Toronto Street, Toronto, Ontario

REFINERY ENGINEERING Company

TULSA TORONTO

Fourth in a series of opportunities to step up production—cut costs.

Planning to Retube a Butane Condenser?

The opportunity to boost heat duty of butane condensers—without the expense of investing in new equipment—is available to processing engineers *right now!*

The secret? Retube with Wolverine Trufin® Type S/T—the only integral finned condenser tube for shell and tube heat exchangers.

By replacing prime surface tube with Trufin Type S/T, you can obtain as much as 2½ times greater shell side surface area in existing equipment. Result: increased heat duty from present units.

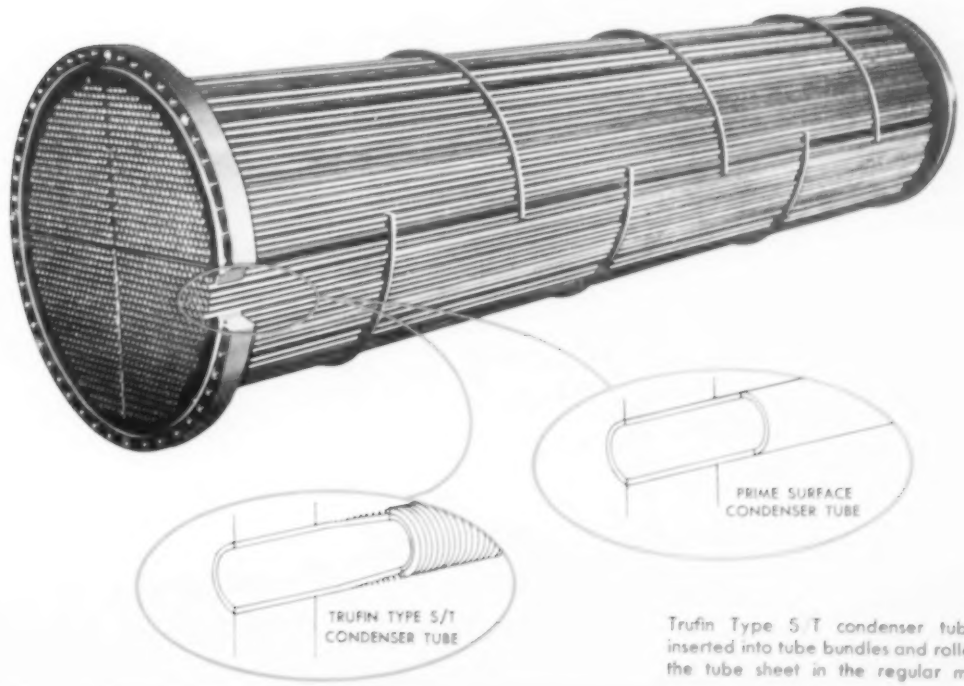
Trufin Type S/T is mechanically interchangeable with plain tube of the same size. It can be rolled or brazed into headers by conventional methods. All the mechanical features of conventional types of heat exchangers as well as the custom designs of individual fabricators can be retained.

®REGISTERED U.S. PATENT OFFICE

Trufin in copper, copper-base alloys, aluminum and electric-welded steel is furnished in a wide range of sizes. It's available with four different kinds of end finishing: both ends finned, both plain, both stripped, or one end plain and the other stripped.

You'll save if you specify Trufin when retubing is necessary. *Call Wolverine right now!* And write for a copy of Wolverine's new Opportunity Book. It's proof positive.

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.



Trufin Type S/T condenser tubing is inserted into tube bundles and rolled into the tube sheet in the regular manner.

A Condenser Tube for Every Job

PRIME SURFACE TUBE

Wolverine keeps in step with processors' demands—not only with Trufin Type S/T, but with additional types of condenser tubing. From this complete line you can specify exactly the tube you need to meet your particular demands. Into each of these products goes all the research, the engineering skill and Tubemanship, that has made Wolverine a leader for more than 38 years. Your tubing dollars develop real stretchability!

PRIME SURFACE TUBE

Wolverine manufactures prime surface tubing in three metals—copper, copper-base alloys, aluminum and electric-welded steel—all quality controlled.

DUPLEX PRIME SURFACE TUBE

Duplex PRIME SURFACE TUBE

Here's a tube designed to handle two types of corrosive attack simultaneously. It is composed of a tube of one metal and a liner of another. The combination can be any alloy you need to meet special conditions.

Duplex TYPE S/T

This tube also is designed for specific corrosive conditions. But, like Trufin, it has integral fins—will boost heat transfer efficiency. It can be used instead of prime surface tube.

DUPLEX TYPE S T

TRUFIN TYPE L/C

A high-finned, lightweight aluminum tube is mechanically bonded to an interior liner of the alloy which best beats your corrosion hazard. It provides maximum heat transfer and trouble-free performance at low cost.

U-BEND PALLETS

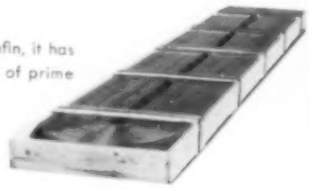
This new Wolverine idea cuts time, reduces storage problems, and saves money. U-bend condenser tubes—either finned or prime surface—are arranged in a disposable box-type pallet in the exact order you specify. All you have to do is feed them directly from pallet to unit.

FIELD ENGINEERING SERVICE

This is a Wolverine "extra"—a staff of highly-skilled tubing technicians. You can get experienced help in solving problems dealing with alloys, corrosion, design or fabrication. You'll find complete information in Wolverine's Condenser Tube Catalog. Send for your copy now. Wolverine Tube, 1441 Central Avenue, Detroit 9, Michigan.

TRUFIN TYPE L/C

U-BEND PALLETS



FIELD ENGINEERING SERVICE

WOLVERINE TUBE

DIVISION OF CALUMET & HECLA, INC.

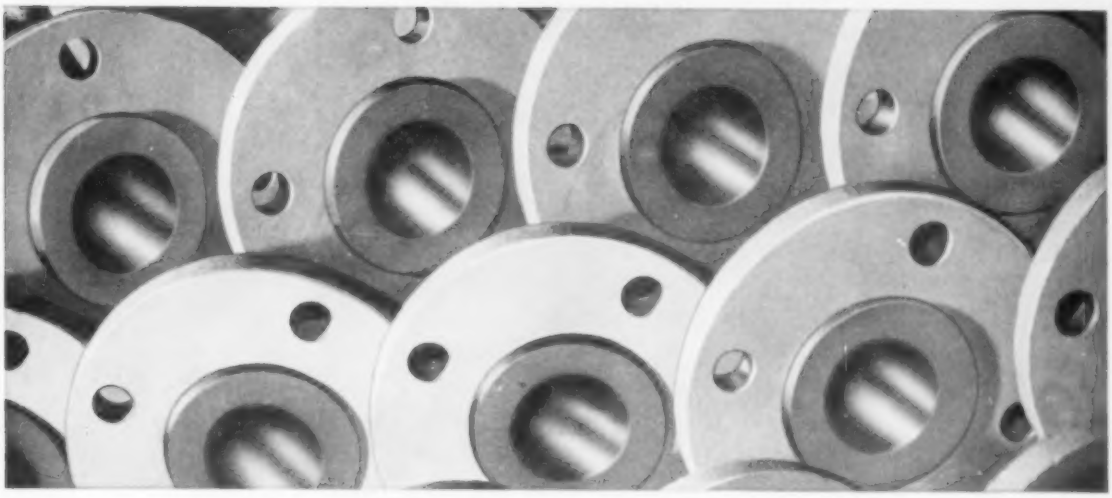
Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 15 EAST 40TH STREET, NEW YORK 16, N. Y.

DOW



You can see why

SARAN LINED PIPE

GIVES LONG, TROUBLE-FREE SERVICE

It's made of corrosion-resistant saran pipe swaged into steel for extra rigidity and strength . . . cuts downtime losses conveying corrosive liquids.

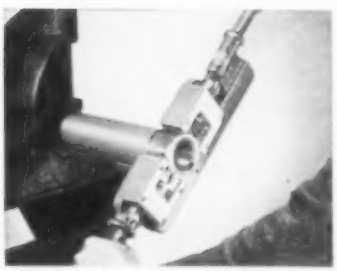
Now you can convey chemicals and many other corrosive liquids without worrying about costly shutdowns due to corrosion. For saran lined pipe, fittings and valves are corrosion-resistant . . . form snug, leakproof joints . . . won't burst under pressure.

They're easily and inexpensively installed because they can be cut and threaded in the field with any standard pipe fitter's tools. Their rigidity means that few supporting members are needed.

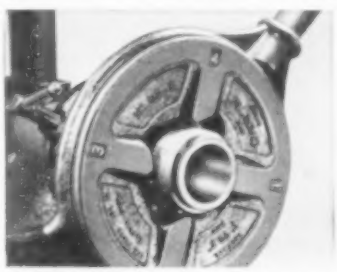
Saran lined pipe, fittings and valves have a proved record in industry of bringing long trouble-free service. If your operation requires superior resistance to most chemicals and solvents, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, Department SP527F, 2415 Burdette Avenue, Ferndale 20, Michigan.

RELATED SARAN PRODUCTS—Saran rubber tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

Saran Lined Pipe Can Be Fabricated Right in the Field!



A Beaver Cutter cuts away the end of the steel pipe so that ⅛" of the saran lining is extended. This assures a tight seal after a flange is applied and connected with another flange.



A ratchet type thread cutter makes the standard threads after the Beaver Cutter has been used. A flange is then attached and the saran liner filed so its ends are flush with the flange.

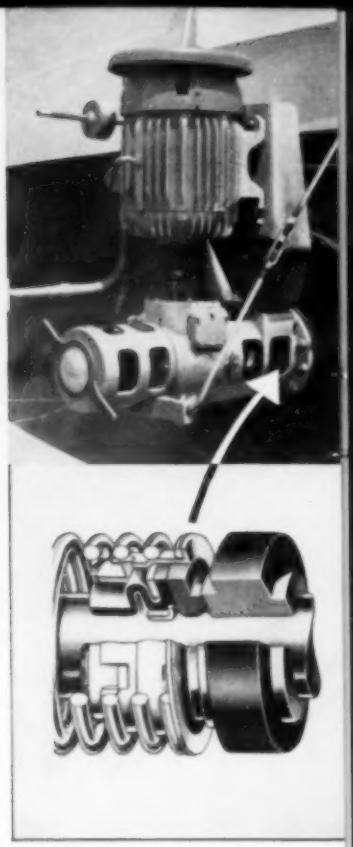
A half gasket is used in each flange or whole one can be used in one of the flanges. Then the flanges are joined. The resulting joint is snug, completely airtight and leakproof.

Saran Lined Pipe is Manufactured by The Dow Chemical Company, Midland, Michigan

you can depend on DOW PLASTICS

DOW

REMOVABLE SEAL CARTRIDGE is a complete *unit* assembly, easy to stock as a replacement, or quickly obtainable in all sizes and materials, for the simplest or most difficult operating conditions.



YOU CAN REPLACE A LIGHTNIN rotary seal in a few minutes—without special skill, without draining the tank or dismantling the mixer, without losing a pint of product. Seal is shown here without housing, to illustrate components.

Newest cost-saver in side entering mixers:

End stuffing box repacking . . . forever

with a rotary seal that's easy to replace

Now you can enjoy the solid maintenance savings of leakproof rotary sealing in a side entering mixer—without the headaches seal replacement *used* to cause.

For here, at last, is a rotary seal that runs *years* without adjustment—yet can be replaced *in a few minutes* when necessary, without draining the tank or dismantling the mixer, and *without need for special skills.*

Here's what you gain when you specify LIGHTNIN Mixers with new LIGHTNIN Seals:

1. You end leakage—for good. The seal positively will not leak during its operating life.
2. You *eliminate* the cost of repacking stuffing boxes. The LIGHTNIN Seal takes the place of a stuffing box. Under most conditions, it runs smoothly for *years* without changing.
3. You stop costly "nursing" of stuffing boxes. The seal *never* needs adjustment.
4. And most important (because it's never been possible before)—you can replace a LIGHTNIN Seal *in a few minutes*, should it ever become necessary. Only one simple *cartridge* component to remove and replace—and you're back in operation. So simple, anyone who can handle a wrench can do the replacement job *in minutes.*

Already, many oil companies are using LIGHTNIN Seals. Users report savings running into many thousands of dollars per year. Your LIGHTNIN Mixer representative can give you the full story—show you how much *you* can save. Call him today. Or get the facts by mail: Send the coupon for 8-page, fully illustrated bulletin.

Get the cost-cutting facts now . . . New 8-page Bulletin B-111 shows how you get maintenance-free sealing that really slashes fluid mixing cost to a new low. Send also for LIGHTNIN Mixer catalogs listed here. Free—no obligation. Just check data you want, tear out and mail to us today with your name and company address.

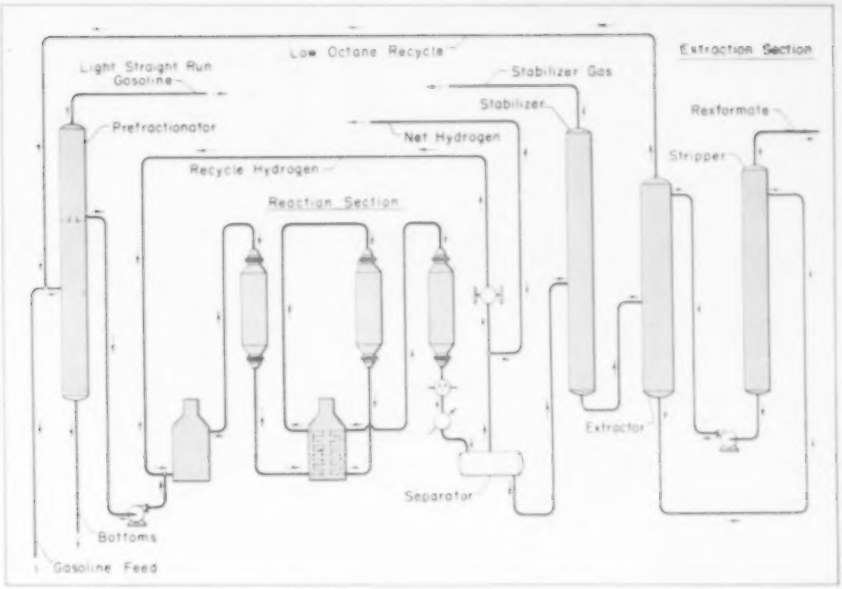
- ☐ B-111 LIGHTNIN Rotary Mechanical Seals
- ☐ DH-50 and DH-51 Laboratory Mixers
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller types)
- ☐ B-104 Side Entering Mixers
- ☐ B-107 Mixing Data Sheet
- ☐ B-108 Portable Mixers (electric and air-driven)
- ☐ B-110 Condensed Catalog (complete line)

MIXING EQUIPMENT Co., Inc., 131-d Mt. Read Blvd., Rochester 11, N. Y.
In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.

Lightnin® Mixers

MIXCO fluid mixing specialists

Petroleum Processing
APRIL 1955



AN INTEGRATED PROCESS. Rexforming combines prefractionation, reforming, stabilizing, solvent extraction, and recycle operations

For Higher Octanes

Try Rexforming for 100 plus

By H. W. GROTE, V. HAENSEL, and M. J. STERBA
Universal Oil Products Co.

REXFORMING, a new process development by Universal Oil Products Co., is aimed at the production of high octane motor fuels. Octane numbers (F-1 clear) in excess of 100 have been produced in laboratory test runs using Midcontinent feed stocks and low naphthene feeds.

Shown in the schematic above, Rexforming is essentially a combination process; integrating feed prefractionation, reaction section proper, a stabilizer, and solvent extraction coupled with a recycle of low octane materials.

The low octane components do not appear in the finished Rexformate, which is a water white gasoline of controlled volatility characteristics. Due to the mild process conditions, side reactions are minimized, catalyst life is extended, and overall yields are high at high-octane levels.

The recycling aspect provides an additional process variable designed to free the refiner from operating limitations imposed by characteristics of feed stocks.

For example, low naphthene feeds can be processed as conveniently as stocks of more normal naphthene concentration, because Rexforming permits more desirable paraffin conversions than are possible in single-pass operations.

Operation is at high space velocities, and catalyst requirements are about the same as those needed for single-pass operations to much lower severities. Units can be readily installed utilizing equipment from existing Platforming units. For the same fresh feed rate, no additional catalyst is required, some additional heat exchange equipment must be added, and the solvent extraction section must be installed.

A cost estimate for a Rexforming installation of the type described in this paper will be about $300/bbl. of throughput to build, and about 36¢/bbl. to operate, excluding royalty, depreciation,

* This article is an adaptation of a paper entitled "Rexforming," and scheduled for presentation by the authors March 29, 1955, at the 43rd annual meeting, Western Petroleum Refiners Ass'n., San Antonio, Texas.

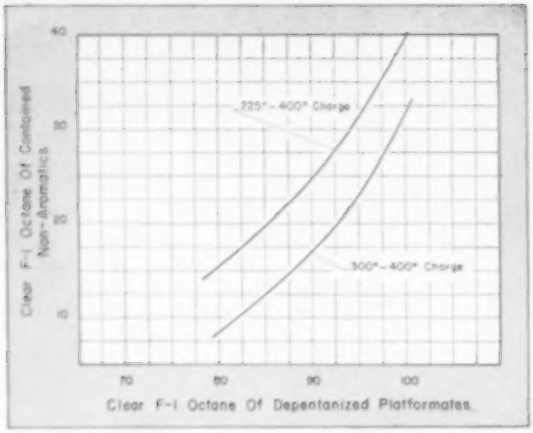


FIG. 1—Octane ratings of non-aromatics from Platformates

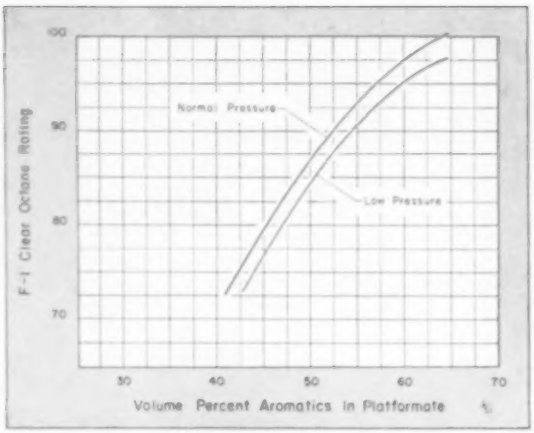


FIG. 2—Operating pressure effect on aromatic contents of Platformates from Midcontinent naphtha

Table 1—Non-Aromatics from a Platformate

Fract. No.	Fract. Boiling Range °F.	Fract. Vol.-% of Total	F-1 Clear Oct. No.
1	Up to 115	14.4	—
2	115-142	9.9	80.5
3	142-151	10.0	68.7
4	151-157	10.0	47.4
5	157-194	9.9	63.3
6	194-199	10.2	55.6
7	199-219	8.8	18.6
8	219-261	13.0	35.4
9	261-306	8.5	9.3
10	306-349	3.9	3.8
11	Bottoms	1.4	Not determined
		100.0	

Table 2—Laboratory Data on Rexforming

Inspections	Mid-continent Feed Charge	Test 1*	Test 2*	Low naphthene feed Charge	Rexformate
Gravity, API	52.5	44.3	37.3	59.6	47.1
F-1 clear octane	30.0	95.2	101.8**	10.3	101.0
Aromatics, Vol.-%	8	56	77	3	59.2
Naphthenes, Vol.-%	—	—	—	12	—
100 ml. distillation:					
IBP, °F.	248	124	120	254	110
5%	264	162	160	265	153
10	270	180	189	268	167
30	289	249	288	282	239
50	312	297	326	296	278
70	340	339	353	320	306
90	370	382	392	351	345
95	379	402	413	365	364
EP, °F.	390	426	429	390	415
Yields:					
Separator gas, SCF/bbl.	—	856	1090	—	940
Debutanizer gas, SCF/bbl.	—	246	296	—	484
Debutanized Rexformate, vol.-%	—	82.9	76.8	—	68.2
10# RVP Rexformate, vol.-%	—	92.3	85.0	—	74.3

* Debutanized Rexformate.
** CRC octane scale extension.

Consider the processing of a full boiling range gasoline. This stock is fed to a reboiled prefractionator which removes overhead a light gasoline fraction. The side-cut is the combined feed to the reactions. Flow through the reactors which contain the Platforming catalyst, and through the heaters is similar to that of a Platforming unit. Reactor effluent, after cooling, passes to a separator, from which a hydrogen rich gas is circulated to the reactors. The net vent hydrogen is also removed from this separator.

The separator liquid is fed to a stabilizer which in this case serves as a debutanizer. The stabilized material is charged to an extraction column, which continuously rejects from the top the low octane number components. This stream returns to mix with fresh feed, achieving selective conversion of low octane heavy paraffins to high octane components.

Separation in the extractor is selective in that the higher boiling non-aromatics, and these are the lowest octane constituents of a reformate, are least soluble in the solvent. On the other hand, the aromatics and the lower boiling non-aromatics, both of which are the high octane components, are relatively more soluble and are removed from the extractor with the rich solvent.

Dissolved hydrocarbons are removed from the rich solvent by stripping, yielding a gasoline of well-balanced boiling range as the high octane product of the process. Lean solvent from the stripper is returned to the extractor.

The reaction section can be operated at mild conditions to produce an effluent having an octane number of 75 to 85 F-1 clear and containing 35-45% aromatics. The extraction section serves to separate from this effluent a stream of increased aromatic content, containing the highest octane paraffins in the reactor effluent. This stream, the Rexformate, when of 100 clear octane number, will contain 60-65% aromatics.

The remaining low octane, higher boiling paraffins are left in the raffinate stream, to be recycled to the reforming section for further processing. Furthermore, minor amounts of aromatics can be left in the recycle raffinate stream without effect on the efficiency of the process.

Thus, investment and operating costs for the extraction section are much lower than those for extraction operations designed to make pure aromatics at high recoveries.

Factors Involved—In earlier papers on reforming we have stressed that for an ideal operation all components of the charging stock should be converted into higher octane

number materials. We have also emphasized that the ideal process should be effective for a wide variety of charging stocks.

The usual charge stocks to reforming operations contain small amounts of aromatics, the balance being naphthenes and paraffins. The aromatics are of excellent octane quality, and are stable at reforming conditions.

The primary reaction of naphthenes in catalytic reforming is the essentially complete conversion to aromatics by dehydrogenation.

Paraffins undergo three reactions: isomerization, hydrocracking, and dehydrocyclization.

The isomerization reaction is the fastest of the three but it is useful only at moderate octane levels because the equilibrium mixture contains substantial proportions of low octane paraffins.

Hydrocracking is a potent means for upgrading the higher molecular weight paraffins, which are of extremely poor octane. The octane number increase obtained is very substantial, and yields are excellent due in large part to the fact that the products are of lower density than the parent hydrocarbons. However, the extent of this reaction must be properly balanced with the other reforming reactions because of volatility specifications.

Dehydrocyclization, or the conversion of paraffins to aromatics and hydrogen, is an important and effective means of improving octane ratings. The fact that this reaction involves a substantial volumetric loss due to both density change and production of hydrogen is overshadowed by the extremely large octane increase. The extent to which dehydrocyclization proceeds in once-through operations is limited by the fact that as aromatic concentrations increase, the rate of additional dehydrocyclization is drastically reduced.

Because of these factors, all once-through reaction products contain small, but important, amounts of residual low octane paraffins. The presence of such materials constitutes a very real barrier to the production of super quality fuels by once-through operations.

To investigate this point, a study was made of the nature of the non-aromatic hydrocarbons, principally paraffins, present in a variety of Platformates. The octane ratings of such materials vary with feed stock naphthenicity and boiling range, as well as reforming operating conditions and conversion level, so that no simple relationships exist.

Typical data obtained from Platforming of Midcontinent naphtha fractions are shown in Fig. 1. For Platformates of 95 to 100 clear F-1 octane ratings, the contained non-aromatics range from 20 up to 40 clear octane, with the lower values being associated with the higher boiling feed naphtha. At higher severities, the non-aromatic portion increases in octane number due to selective removal of heavier paraffins both by dehydrocyclization to aromatics and by hydrocracking to lower boiling, less reactive, and higher quality paraffins.

A detailed examination of the non-aromatic portion of a different Platformate is given in Table 1. It will be noted that the lowest octane ratings are associated with the highest boiling fractions.

It is evident from these data that even a few percent of the higher boiling non-aromatics are seriously detrimental in superoctane fuels.

One procedure considered for offsetting the presence of low octane paraffins was operation at reduced pressures. This increases the production of aromatics, but leaves poorer quality paraffins in the product. Examination of Fig. 2 shows that lower pressure operations require higher concentrations of aromatics at given octane levels over the entire octane range. This holds for various and very different feed stocks, and can only mean that the non-aromatics in these products are of poorer quality at the lower pressures.

Aromatic concentrations can be reduced by improving the nature of the non-aromatics. Some measure of the extent to which this is practicable has been studied at a clear octane level of 96. Here, a 10% decrease in aromatic concentration can be accomplished if the quality of the non-aromatics can be improved from 50 to 65 F-1 clear octane. This effect has been of importance in our approach to this problem.

Our research staff has been led to the conviction that efficient reforming to superoctane levels can be accomplished only by selective treatment of the low octane paraffins. The process to accomplish this requires a partial conversion of such paraffins under mild conditions to maintain a proper balance between the reactions of hydrocracking and dehydrocyclization without undesirable side reactions which produce excessive quantities of gas and coke. This partial conversion requires in turn the continuous separation and recycle of unconverted material to the reaction zone.

The application of liquid-liquid solvent extraction techniques was found to be appropriate, after consideration of alternate separation methods. By careful selection of solvent and operating conditions, it is practical to selectively dissolve all types of high octane materials, both the aromatics and the low boiling non-aromatics. At the same time the high boiling low octane components are rejected by the solvent. Fig. 3 illustrates the relationships involved for a solvent which may be used to dissolve all gasoline boiling range aromatics along with the low boiling, high octane paraffins and naphthenes. The use of such a solvent permits separation of reactor effluents into a superoctane portion and a low octane stream. This latter material is then available for selective upgrading to high octane gasoline, or for special uses such as a refined jet fuel component or paraffinic solvent.

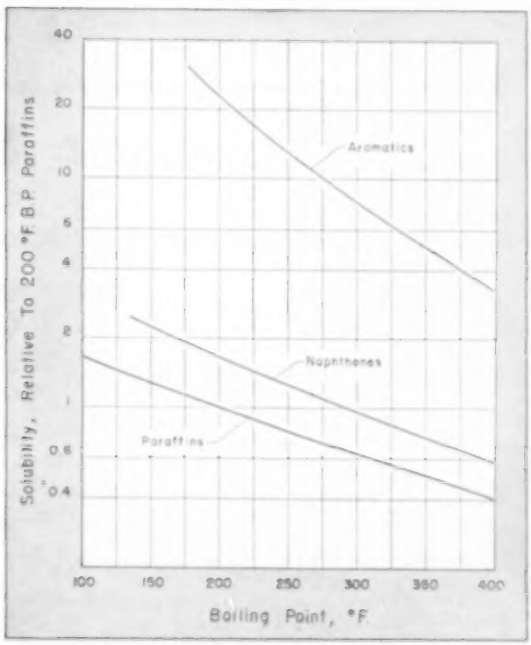


FIG. 3—Relative solubilities of various hydrocarbon types

The low octane stream may be handled in a separate catalytic reforming section, however, experiments in completely integrated laboratory and pilot plant units proved that recycle of this material to the catalyst in admixture with raw feed is completely practical. Such operations are characterized by low recycle ratios and high liquid recoveries of very high octane gasolines.

Discussion of Results

A substantial number of runs have been made in completely integrated Rexforming units, both on laboratory and pilot plant scale.

The results, shown in Table 2, were obtained with a Midcontinent naphtha in a laboratory unit. It will be observed that the octane number range covered by these tests is from about 95 to 102 F-1 clear. The aromatic contents of the Rexformates corresponding to these octane numbers range from 56 to 77%, and, as one might expect, the lower boiling fraction contains the higher octane paraffinic components, while the higher boiling fraction is essentially completely aromatic.

One of the most interesting features of these runs is the relatively low severity required for the production of these octane numbers. For example, both tests 1 and 2 in Table 2, were run at the same temperature level. This temperature was more than 50° F. lower than would be required for once-through operation to the lower product octane number shown. In addition, space velocities utilized were higher on the basis of fresh feed than those ordinarily employed for once-through operations at considerably lower octane levels.

It is difficult to make a valid comparison in yield at 100 clear octane number between Rexforming and once-through operations, because once-through operations suffer from instability at the requisite very severe operating conditions. These also have a very adverse effect upon the yield-octane relationship. Undoubtedly, the yield differential between Rexforming and once-through operations increases with increasing octane numbers.

Table 2 also shows the results obtained in processing a highly paraffinic naphtha. This charging stock was deliberately selected to demonstrate the versatility of Rexforming.

Table 3 shows the properties of the various streams obtained in Rexforming pilot plant operation. These data were obtained on a Midcontinent naphtha feed.

The most important point is the relatively low octane number of the reactor effluent, indicating that a very mild reaction severity was utilized. A 41-octane number recycle stream was separated from the reactor effluent and recycled to commingle with fresh feed. Thus, the feed to the reactor was increased, by about 40%. Since a higher space velocity was used in this case, less catalyst was actually required than for conventional once-through operations.

The overall result is shown in the last column, where the product is of good volatility characteristics, has a clear octane number of 97.2 and was obtained in a yield of 80.5% by volume.

Although in this particular operation the low octane stream was completely recycled, all or a portion of this material may be withdrawn as a net product.

This stream is ideally suited for inclusion in such valuable products as jet fuels.

Economics of Rexforming

The approximate investment and operating costs for Rexforming are given in Table 4 on the basis of charging 5,000 b/sd of full boiling Midcontinent straight-run gasoline and producing 101 F-1 clear Rexformate.

It is thus estimated that the Rexforming process for this type of operation costs about $300.00 per barrel to install and about 36¢ per barrel to operate including the costs itemized in Table 4. These are reasonable costs when it is considered that the product is of such high quality.

No valid cost comparison with established once-through operations can be made at this high octane level. It should be pointed out, however, that the increased yield from Rexforming makes this process economically attractive even at the lower octane levels at which real comparisons can be made. In some cases the economics of Rexforming can be further improved by diverting the highly paraffinic recycle to jet fuel uses.

Table 3—Pilot Plant Rexforming Data

Midcontinent Feed Stock

	Fresh Charge	Rerun Bottoms	Combined Feed	Stabilized Reactor Effluent	Low Octane Recycle	Debutanized Rexformate
Gravity, °API	52.3	29.5	56.1	52.4	63.4	47.0
F-1 Clear Octane	33.0	—	—	76.3	41.0	97.2
Aromatics, Vol.-%	9	—	—	37.5	8.5	53.5
100 Ml. Distillation:						
I.B.P., °F.	242	417	168	133	114	93
5%	259	431	227	172	148	109
10	264	436	241	194	165	121
30	292	—	271	245	225	173
50	316	—	298	280	266	262
70	346	—	332	313	300	309
90	374	—	367	366	355	367
95	384	—	376	387	378	393
E.P., °F.	415	—	395	424	420	424
Quantities, Volumes Per 100 Volumes Net Feed	101.4	1.4	144.6	125.1	44.6	80.5

Table 4—Estimated Investment & Operating Costs for Rexforming

Basis: 5000 b/sd Midcontinent Full Boiling St. Run Gasoline* Producing 101 F-1 clear Rexformate

	Total
Erected Cost: (Within Battery Limits)	$1,600,000
Operating Costs (¢/bbl. Full Boiling Gasoline):	¢/bbl.
Operating Labor @ $2.75/hr.	4.0
Laboratory	1.0
Utilities:	
Fuel @ 15¢/MM BTU	7.3
Power @ 0.8¢/KWH	4.0
Steam @ 30¢/M lb.	4.6
Water @ 1¢/M gal.	1.4
Catalyst	6.9
Solvent	1.7
Maintenance @ 3% of investment/yr. (Labor & Materials)	2.8
Insurance & Property Taxes @ 2% of investment/yr.	1.9
Total Operating Costs (excluding Royalty, Depreciation, Administration and Overhead)	35.6¢

* 4300 b/sd fresh naphtha charge to reactor section

NEW 16-DISTRICT ARRANGEMENT for OCAWIU replaces eight-district set-up of oil workers and 12 for chemical workers before merger

What Does 'Big' Union Mean?

***Definitely**—hefty drive for more members and higher wages*

***Strongly probable**—further mergers with independent unions*

***Still unknown** —Will iron-hand approach with strike threat be used?*

PETROLEUM and petrochemical companies will be watching in the days and months ahead to see how the newly formed Oil, Chemical and Atomic Workers International Union (CIO) implements two programs adopted last month in Cleveland:

1—An organizing drive to increase membership eventually to one million.

2—A wage policy aimed at getting a 5% increase for 1954 and an unspecified additional increase for 1955.

Some company men don't look for any great change in OCAW-CIO bargaining efforts in the near future from what the Oil Workers International Union (CIO), which merged with the United Gas, Coke and Chemical Workers of America (CIO), had been doing in past months.

In other company offices, however, view was expressed that the union probably will make its organizing activities paramount, despite the time union officers will have to devote to physical merger of the two unions—transfer of properties, enlarging former OWIU headquarters at Denver to accommodate increased staff and files, etc.—and time spent on wage negotiation matters.

A merger of OCAW and the independent oil unions may be next on the calendar. Efforts of OWIU and the independents to effect a merger bogged down last year when, as O. A. (Jack) Knight, president of the new OCAW and former OWIU head, put it: "Many of the independent union leaders who promised support fell by the wayside and some were removed from office." The recent merger agreement between CIO and AFL can swing a lot of weight on this question.

With merger of CIO oil and chemical workers now accomplished, OCAW would not say definitely that it would again tackle the independents, but a spokesman did say: "We will continue constantly to keep up an interest in the merger of various unions in oil, chemical and atomic fields." Knight predicted marriage of OCAW and AFL Chemical Workers "within a year, possibly a little longer."

OCAW says it "definitely" will seek blanket coverage of the entire nation by seeking to build up oil strength in the East and chemical strength in the West. Oil workers' strength now lies mainly west of the Mississippi River, while that of the chemical workers is principally in the East.

The union "is not prepared to say" whether it will concentrate on any one segment of the oil industry in its organizing campaign. Admittedly its oil production membership is thin, but since most production workers also are west of the Mississippi, any concentrated drive in that direction would slow down a push to the East.

As to other oil industry segments, the only word forthcoming is: "We want to organize all, but priority will depend on circumstances."

Plans to organize petrochemical workers are a little more specific. Before the merger convention, du Pont was mentioned as a prime target in this field. The union now says it also seeks petrochemical workers in Carbide and Carbon, Dow, Allied Chemical & Dye "and many others," but says there is "no specific priority schedule."

When the organizing campaign gets under way, it will have CIO President Walter P. Reuther's blessing and will get CIO financial support.

Reuther sent word to the Cleveland convention that the huge unorganized part of the petroleum, chemical and related industries will be the No. 1 target of the new federation growing out of the CIO-AFL merger.

He pledged CIO's strength, manpower and resources to help build OCAW "into one of the biggest, strongest and most responsible trade unions in the U. S."

Considerable CIO financial aid will

Here Is What the New Union Will Seek

FOLLOWING is the complete text of a report and recommendations adopted last month by the 54-member bargaining policy committee of the new Oil, Chemical and Atomic Workers International Union (CIO):

I

As regards those bargaining units in the oil industry which were covered by the previous bargaining policy of Oil Workers International Union:

1. Company offers should be examined further to establish:

(a) Possibility of obtaining not less than the original wage increase request made to industry in 1954.

(b) A satisfactory effective date for the application of any increases obtained.

(c) Retention of satisfactory wage re-opener clauses for future use.

(d) That no unsatisfactory company provisos are attached to wage increases.

2. The Chairman of the Policy Committee shall be authorized to determine when satisfactory offers and conditions exist for settlement in line with points listed above.

3. All settlements shall be based on cents per hour increase unless the Chairman authorizes deviations to groups accepting a percentage increase under special circumstances.

4. The Bargaining Policy Committee wishes to make it clear that any settlements made at this time should be considered settlements due in 1954 and that this Union should seriously consider the possibility of asking for additional wage increases for 1955. For this purpose, the Bargaining Policy Committee recommends that it be called to meet in the near future to consider a 1955 wage program consistent with the needs of our members and conditions existing at that time.

II

As regards those bargaining units formerly a part of the United Chemical Workers, the Committee recommends that they continue to bargain in accordance with past practices pending thorough studies which can reveal the basis for future coordinated bargaining programs which may be suitable in the companies and industries with which they bargain.

III

The Committee recommends that the Oil, Chemical and Atomic Workers International Union announce as its objective the eventual establishment of an orderly, systematic and simple code of job classifications and rates within each of the various industries whose workers it represents; that all inequities in each industry be eliminated; that insofar as job conditions and requirements warrant, wage inequities between the various industries be eliminated.

In preparation for this program, the Committee requests the President to instruct the International Research and Education Department to conduct a thorough study, in cooperation and conjunction with the field staff and the Local Unions, of the presently existing wage rates, brackets, job classifications and job descriptions in the various industries whose workers are represented by this Union.

IV

The Committee further recommends that all bargaining committees institute negotiations to seek to secure the following improvements:

1. Increase of shift differentials to at least 10 cents hourly for the 4-12 p.m. shift and 20 cents hourly for the midnight to 8 a.m. shift.

2. Eliminate the sub-contracting out of work. For this purpose, the Committee suggests that the International Union prepare and issue a special supplement to this report setting forth suggested collective bargaining approaches to the contracting-out problem.

3. Eliminate the practice of working excessive overtime by establishing overtime compensation of double the straight time rates of pay.

4. Increase holiday pay for holidays worked to three times the straight time rate.

(It is understood that this section is not a mandatory program under terms of the Constitution, but it is recommended that all units carry on a coordinated and aggressive program on these items of negotiation.)

---

be furnished by the United Auto Workers. This union is conscious of the fact that other, more established unions helped to build the UAW to its present prominent position. Reuther said that UAW is "prepared to repay that debt to the union movement by helping you and other unions organize the unorganized workers of America."

Reuther asserted that with a "combined membership of more than 200,000," the merged oil and chemical unions "will receive more respect at the bargaining table."

Actually that 200,000 figure is the number of employes OCAW claims to represent at the bargaining table, but its per capita dues paying membership is much less than that. Actual membership figures are not made public, but it was indicated that oil membership is about 93,000 and chemical membership about 75,000. Voting strength of all locals having delegates at the merger convention totaled 162,070—90,602 oil and 71,468 chemical.

There was no talk of "loaded guns" or "unloaded guns" as the OCAW's new bargaining policy committee met after the convention and urged locals to re-examine the current 10¢/hr. increase offers in the hopes of bettering them. The committee recommended holding a meeting in the near future to consider demanding further increases for 1955.

All outward indications—both the policy committee report and expressions of President Knight—indicated that the union would seek by peaceful means to get settlements for the former OWIU locals as close as possible to the 5% demanded in 1954 instead of accepting the 10¢ offers being made by a number of oil companies, which OCAW says is about 4%.

"The Bargaining Policy Committee wishes to make it clear that any settlements made at this time should be considered settlements due in 1954 and that this union should seriously consider the possibility of asking for additional wage increases for 1955," the committee's report said.

But, in company offices it was felt that the 10¢ offers "may be taking hold" among independent unions and that OCAW would be forced to follow that pattern. Also, doubt was expressed whether OCAW was serious about starting any new wage negotiations covering 1955.

Typical management comments

were: "I rather imagine settlements will be made on the basis of the 10¢ offers," and "I think the 10¢ offers have a good chance of being accepted."

OCAW's Bargaining Policy Committee report also recommended that bargaining committees institute negotiations aimed at obtaining increases in shift differentials and other improvements.

Shift differential increases to at least 10¢ hourly for the 4-12 p.m. shift and 20¢ for the midnight to 8 a.m. shift were recommended.

Bargaining units also were asked to negotiate for elimination of "subcontracting out of work," elimination of the practice of working excessive overtime by establishing overtime compensation of double straight time rates, and increase in pay for holidays worked to treble the straight time rate.

The method of electing OCAW officers in the future has been left for the 1956 convention to decide. This will be held between Aug. 1 and Oct. 31 at a date and place to be designated by OCAW's executive board.

A fight over this and over redistricting had been expected to develop on the convention floor. With the election issue postponed until next year and the matter of redistricting settled behind closed doors by the constitution committee, the only battle that took place was over choice of vice-presidents.

On the election question, the oil workers wanted to substitute the referendum plan for nomination and election from the convention floor, favored by the chemical workers. Knight, who had remained as OWIU president since 1940, won the election as OCAW's first president under the chemical workers' method. Unopposed, he was elected unanimously by acclamation as was T. M. McCormick, OWIU secretary-treasurer, to the same post in the new union.

In electing four vice-presidents of equal rank, the delegates dumped Robert P. Buchanan and Cecil Martin, who had been elected vice-president and secretary-treasurer, respectively, of the chemical union at its September convention in St. Louis. These men lost out on a three-hour roll call vote to Joseph Appelbaum and Jack Curran, candidates for office at the St. Louis meeting. B. J. Schafer, former OWIU vice-president, and Elwood D. Swisher, former chemical union president, won the two other vice-president posts without opposition.

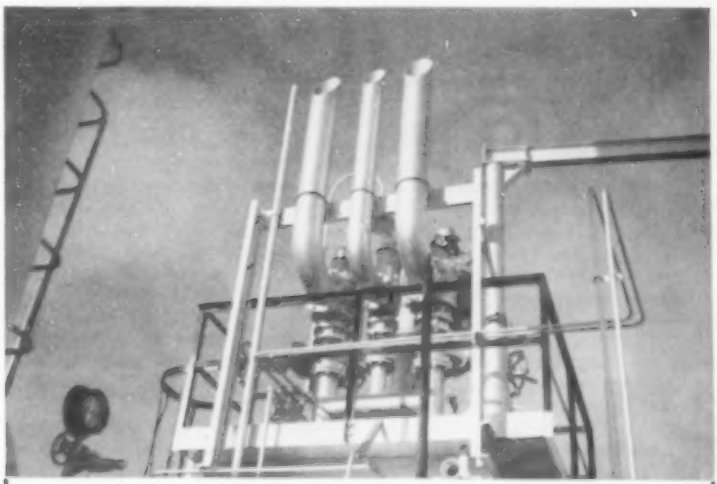
Nine oil delegates were elected to the international executive board, seven were elected alternate members and eight former OWIU members were appointed district directors. The six top officers, board members, alternates and district directors constitute the union's 54-member Bargaining Policy Committee.

A committee recommendation that 16 districts be set up was adopted. Fifteen are in the U. S. Canada comprises the 16th. OWIU previously had eight districts and the chemical workers 12.

Atomic workers were included in the name of the new international to give recognition to small units formerly represented by both the oil and chemical unions. OCAW gave every indication of organizing workers in this field as well as in oil and chemical plants.

A resolution adopted during the course of the convention urged Secretary of Labor Mitchell "to proceed with his study of collective bargaining procedure in the atomic energy industry to develop new methods and techniques for strengthening collective bargaining for workers and industry in this field."

As to specific plans for organizing atomic workers, OCAW would only say: "We have several ideas in mind, but prefer not to discuss them yet."



THIS MONTH'S COVER

• The three inverted "elephant trunks" pushing skyward are scrubber vent pipes on the world's first commercial Fluid coking unit, a 3600 b/d installation which was formally dedicated at Carter Oil Co., Billings, Mont., March 18.

Borrowing the fluidized solids technique already successful in other forms of petroleum processing, the unit takes low value residual oil and 1) breaks it down for conversion into marketable motor and burner fuels, and 2) manufactures petroleum coke of highly salable properties.

On stream since about the end of January, the new coker has been meeting all Carter expected from it in the way of performance. Preliminary data indicate yields are in line with those predicted from pilot plant work. Reaction temperatures have been held closely by automatic controls. Scrubber operation, including slurry and gas oil streams, has been satisfactory. Particle size growth has been easily controlled.

An inherent advantage Carter sees in the Fluid coker is that it can operate on an extremely low API gravity feed—as low as an asphalt. This gives flexibility: the processor can run to make asphalt when the market is hot for it, or can switch to coking when asphalt market gets sticky.

Watch PETROLEUM PROCESSING for a staff-written complete description of the new Carter coking unit—it's coming soon.

Keep those Pressure Vessels Safe

Beginning a series of four authoritative articles on how to maintain safe operation of unfired pressure vessels

INSPECTED

PART 1—ORGANIZATION AND SCHEDULING

By WALTER SAMANS
Consultant on Pressure Vessels

SAFETY is always the first requisite in the operation of unfired pressure vessels as for any other industrial equipment. However, inspections alone cannot assure pressure vessel safety if engineering principles are not observed during the entire life history of the equipment.

While safety valves are necessary, they only provide protection against excessive overpressure or a prohibitive degree of vacuum, not human failures.

Admittedly safety cannot be attained 100%, but the failure to reach that standard should never have to be blamed on the lack of good inspection. Beyond that duty, plant inspectors should not be expected to exercise control.

In the design of any structure, economic considerations cannot be neglected, as these are fundamental in the competitive effort by which our morale as well as our living standards can be maintained.

With competent engineering throughout a project's life from its conception on, safety need not suffer. The engineers responsible for safe design and construction, in modern practice, will avail themselves of the advice of the operating and inspection staffs.

The use of greater thicknesses of steel or alloy in pressure vessels than is needed in critical areas may add a hazard in the strain and stress pattern rather than give greater safety. This is well known to stress analysts who are frequently called in on the more complex designs of processing vessels.

Early Inspection Requirements

Fifty years and more ago, the inspection of pressure vessels of simpler form, lesser size and of plain cast and rolled iron or steel, required only an observant type of mechanic, engineer, or other craftsman.

Their reports, often made verbally, were normally limited to what they could see, what they could sense by touch or by ear in hammering on the wall of the vessel and its piping connections, and tapping rivets with a light hammer.

For inspecting surfaces that showed corrosion, cracks or overheating, chemical etching was sometimes used. This practice began with drums on boilers which were embrittled by concentrates of caustic in feed water.

The experience of that time was naturally that gained with riveted construction. Brazing was used on small vessels mostly, and gas welding came later.

Pressure vessels of the earlier period were of simple design mainly because service pressures and temperatures for chemical processes were moderate, and for the petroleum industry they were low as compared to modern practices.

Pressure relief in earlier days was generally accomplished by weighted safety valves. For small portable tanks, rupture discs were first used due to limitations imposed by shipping requirements.

Tanks of all sizes in stationary service, to be filled with liquid with small outage, were usually equipped with safety valves supplemented by liquid relief valves.

Spring-loaded valves came into use naturally as pressures became higher, as they cannot be tampered with as easily as could weighted valves.

Evolution of Inspection

Today's manufacturing processes may require very large pressure vessels, and these may have greatly increased imposed loadings as compared to those of thirty years ago. As the result of higher pressures and temperatures, as well as of greater process corrosiveness, many varieties of high alloy steel had to be developed. These steels had their own peculiarities, adding to the burdens of the field inspectors after the vessels went into service.

Technical progress required that the inspectors have devices to assist their natural senses. Such devices were developed as the need arose. Now the inspector can virtually *see* below the surface, *see* and record the thickness of the metal, and *hear* the nearness and extent of serious defects.

Most vessels are now of welded construction. Where radiographs cannot be taken because of weld shape or inaccessibility, magnetic particle and etchant methods are used.

Sampling, that is cutting out pieces of the vessel wall or only sections of a weld and the adjacent heat-affected zone, is seldom used. But sampling can be resorted to when physical properties of the metals as influenced by service conditions have to be checked to determine whether the safety of the vessel is endangered.

Management and Inspection

In business management it may be conceded that there is a well respected precept of not withholding dollars if by doing so a hazard to personnel is added. It would be economic folly to do otherwise.

In the course of standard inspection procedures, inspectors should be asked to make at least periodic summary reports to management, adding special reports on all unusual occurrences in connection with their findings.

Percentage-wise, the rate of pressure vessel failure occurrences due to over-pressure—as compared to the growth of the size, number and complication of design and service conditions—has become more favorable in industry by correcting practices that had contributed to these failures. Both management and inspection have contributed to this improvement.

Like other continued activities where large numbers of employes are

utilized, there is a constant turnover of inspection personnel. Management has the responsibility of seeing that the new employes are trained not only in the plant's practices and rules, but also familiarized with the process equipment of which pressure vessels may be the heart.

Absolute safety is, as it should be, the aim of good inspection and the responsibility of management.

Codes and Safety

Basically, rules for the construction and inspection of pressure vessels, with some requirements for their installation and the use of safety protective devices against over-pressure, were written around the best experience available as each new issue of code rules were prepared.

Cooperation of the engineers in the industries affected has been fostered by code writing bodies. It must now be realized that inspectors and codes alone cannot bear the entire responsibility for safety. The operators of such vessels should also take an active interest in order to guarantee that the vessels' predictable operating future can be practically met.

Inspection Department Organization

The kind of plant inspection department which is made responsible for the processing vessels and their safety devices will depend on the extent and product capacity of the entire plant. Also the parent company's organization and that of its affiliates—along engineering and similar lines—will influence the type and size of inspection force needed.

It is a first duty of management to determine the policy for each of the plants in their charge as to the type of inspection department necessary for their operations. Management should also set the policy as to whether inspectors should be full-time, part-time assisted by technical help within the organization, or from outside agencies.

In the table of organization, the chief inspector should be primarily responsible to the plant's top management, and be subject to the discretion of this higher authority only when conditions seem to warrant it.

Inspectors under the chief inspector always have a nominal responsibility to the plant's management, but their first direct responsibility is to their chief inspector or shift inspection supervisor.

Inspection Personnel

Management should keep up with inspection progress, including the need for setting proper qualifications for all inspectors.

All of the classifications of inspection personnel, in number and in character, should be based upon a plant's individual needs. Those directly responsible for inspection results must be men whose judgment can be trusted in situations where explicit rules cannot be set beforehand.

Since in the processing industries there are numerous corrosive forming reactions that may alter with a required change in the process, it has become the practice to give preference to applicants having some technical training. However, for all but the most complex plants, mechanical craftsmen may be trained to carry on routine service inspections.

To advise mechanical craftsmen inspectors in cases of apparently unexplainable defects or rapid deteriorations, there should be on call mechanical, metallurgical and chemical engineers. In any case, such engineers may be needed for periodic checkups by management.

In connection with effective inspection, the value of good mechanics and skilled craftsmen should not be overlooked. It is sometimes the small defect resulting from an oversight or a bad repair practice that jeopardizes real safety. Only the best available mechanics and craftsmen should be used in making repairs or additions to a vessel's pressure parts.

The Chief Inspector

For efficient operation, in the larger inspection groups, the chief inspector should be familiar by his own experience, with the design, construction and inspection procedures for the kinds of pressure vessels to be placed under his care.

He should be preferably a graduate engineer. Likewise, some of the inspectors working under the chief inspector should have technical training in order to be eligible for promotions.

In small plants, the chief inspector may have only one or two assistants, and himself be subject to emergency calls at night. In this case it is even more important that the chief inspector have a well rounded background and technical knowledge.

A chief inspector's duties may include some or all of the following, as regards pressure vessel inspections:

1. To set up and maintain the inspection organization in an effective manner, particularly in avoiding overlapping duties and internal conflicts.
2. To promote efficient performance by a constant surveillance of inspection and repair assignments, including the revision of reports as operating conditions are changed.
3. To recommend the minimum intervals between inspections for each situation as it arises, and approve (or contest) any extensions of such intervals requested by responsible superiors, as governed by his own findings.
4. To make suggestions for methods of repair and/or equipment replacement for materials found unsuitable as installed, checking back to the original specifications.
5. To recommend reconstruction of critical places found inaccessible for effective inspection, or the complete replacement or abandonment of the vessel, at least for its existing service.
6. To make periodic summary reports to management, or as requested by plant (unit) superintendents. Semi-annual reports are suggested, except for vessels nearing the end of their useful life because of corrosion losses.

In some plants, the kind of an inspection organization most practicable will place the responsibility for final action on some of the above items with the engineering department, which in turn will report on such matters directly to the plant management.

Also, the chief inspector may have the inspection of safety pressure relief devices under his jurisdiction. If he does have control over the inspection of these devices, he may request that special inspectors or mechanics be assigned for that service.

These safety valve inspectors will usually follow required adjustments and repairs through the valve repair shop. However, they may be in a situation where the inspection department has no say on the actual work done by the valve shop personnel where this shop is under the jurisdiction of the maintenance or other operating departments.

Safety Valve Inspectors

A safety valve inspector may not, and need not, take any part in other inspections made on pressure vessels. If, however, he is specifically charged with keeping these valves in their best

INSPECTED

operating condition, he should be fully trained.

For adjustments or resetting of safety valves—particularly springs—when conditions of operation must be changed, it is well to have a plant's safety valve inspector qualified at the valve manufacturer's shop. The manufacturer, having a guaranteed responsibility for the valves, is usually glad to check the competence of the user's employe specifically responsible for the valves. At the same time, the user may thus comply with the law—where it exists—which requires that such employes be qualified in that manner.

Inspection Scheduling

The methods applied to service inspections of pressure vessels are by definition "purpose served" requiring practical schedules for periodic field inspections. This is opposed to shop inspections which are made "as required" for fabricated dimensions and tolerances.

Previous examinations may best determine the future inspection schedules for individual pressure vessels. Also experience gained from inspections of vessels in similar service—as to the extent of the areas or parts suspected of having some structural weakness from which progressive failure may result at some approximately predictable date—will serve to determine inspection schedules for specific equipment.

Where a governmental agency has jurisdiction over service inspections, their authority should be tempered by adjusting their requirements with those of the plant management, by mutual agreement.

Inspection schedules—as to exact dates when the necessary shutdowns can be made—must be subject to some operations control, with the approval of management.

General recommendations for inspection schedules will be found in the operating manuals usually prepared by process engineers for large industrial units. For the petroleum industry they are outlined in the *Recommended Practices for Refinery Inspections, Part 1, Process Equipment (1948)*—now being revised and modernized. Some similar rules first appeared in the industry's *API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases, 1951 edition, Section I, and supplement published in 1954.*

In industries where long continued full flow at a high temperature is the only practical way of operation, inspection schedules of unfired pressure vessels usually will depend on the operating procedure and the fouling rates for the plant of which they are an integral part—that is for plants which cannot operate when these vessels are out of service.

The schedules set and usually maintained in power steam-generating plant could not serve as a pattern for periodic field inspection schedules for unfired pressure vessels in the process industries.

When in corrosive service, the maximum periods between pressure vessel inspections should not exceed one-half of the estimated remaining safe operating life of the vessel, or five years, whichever is less.

Inspection Records

Successful results are imperative in present day operations of large capacity integrated processing units, and the most exacting records should be kept of any special methods devised for first inspections made on new vessels, as well as of new and improved methods for old vessels.

Only in this way can assurance be given that unexpected shutdowns due to oversights incidental to periodic inspections and repairs will not be repeated as personnel is changed. These records will also serve as the basic information for training new men, and help them to realize their responsibilities.

Critical legal responsibility may face a pressure vessel inspector on the occasion of an accidental failure or unforeseen hazard created by misoperation which causes personnel injury. Even though there may be questions raised as to the effectiveness of past inspections, a full-time plant inspector is far better qualified than any outside or part-time inspector to resolve difficulties which may occur. This is the best argument for maintaining complete records and a full-time inspection staff.

Inspectors and Operations

Inspection personnel should be able to get effective cooperation from the plant operators. Inspectors should not court favors from operators by disregarding any of their own delegated authority and duties, but should obtain cooperation more by the force of their own personalities.

When a dispute or even a serious difference of opinion arises with the operating personnel concerning the inspector's recommendations, it is preferable that management should settle the dispute in most cases.

Under circumstances of disagreement, it may be considered quite reasonable for the inspection department to accept an offered compromise, where the immediate problem does not involve a serious hazard.

Where any compromise solution is contrary to the chief inspector's best expressed judgment, he should be permitted to register his objections in writing, with reasons therefore, to the plant manager.

Advance knowledge of "what to look for" during inspections should be furnished to the field inspectors concerning defects to be anticipated during the vessel's operation. Inspectors on such units are therefore given every opportunity to learn the details of operation first hand, in order to make intelligent inspections.

Meet the Author

Walter Samans, consultant for Sun Oil Co. on Fuel Terminals, was born in Goes, Holland, becoming a U. S. citizen in 1904. Educated in Philadelphia, he received his B.S. in M.E. from the Univ. of Penna. in 1905. Except for the years from 1906 to 1916 when he was Asst. Chief Engineer for The Bessemer & Lake Erie R. R., he was with the Atlantic Refining Co. from graduation until 1937 as Design Engineer, Asst. Chief Engineer, and Chief Engineer. From 1937 until retiring in 1950 he was Mechanical and Administrative Engineer with Sun Oil Co. Mr. Samans has been active in API since 1926, and in ASME committee work since 1934, serving as chairman on numerous occasions. Starting in 1940, he served on many committees for the Army, Navy, and Defense Departments as member and chairman, and edited numerous military handbooks on terminal bulk and storage operations. Walter and his wife Katharine have two sons, Carl H. who is Assoc. Director, Engrg. Research for Standard of Ind., and Walter A. who is Field Project Manager for E. I. du Pont de Nemours.

What to Look for in . . .

Choosing Grease Making Equipment

By O. L. YARHAM
Cities Service Research & Development Co.

GREASE making, once considered an art, is rapidly becoming a science. High quality, more uniform product demands; new grease types; greatly increased labor costs—far greater than the corresponding rise in delivered prices of greases; and higher costs for special thickening agents are all factors that have forced grease makers to study equipment performance and selection more closely.

The importance of proper selection is illustrated by this experience in the manufacture of identical greases in four different plants:

One plant made uniform grease in six hours with only reasonable attention by the grease maker.

A second plant required 10 to 12 hours to make uniform grease.

A third required 16 to 18 hours and very close constant attention by the grease maker.

A fourth never did succeed in making specification grease: all products were off-test.

What was the difference among these plants? One very large and important answer certainly could have been in the time and care given the selection of the equipment.

The Grease Kettle and Accessories

Drive Mechanisms

Be sure that the kettle is properly powered. Under-powered, inefficient equipment will result in lower quality, less uniform products. Greases are complex physico-chemical systems; hence variations in results due to improper control of mixing and temperature often are quite subtle and difficult to determine.

Today's mixers average in working capacity at 2000 gals., or about 15,000 lbs. Sizes range from a few hundred to 30,000 lb. Equipment manufacturers report that where 30 to 50 hp. drives were once supplied for large mixers, drives ranging from 60 to 200 hp. are now being furnished.

A successful design in use for several years is the double-motion drive-head. Properly selected bearings are applied to support radial loads and thrust loads in either direction. Moving parts are lubricated in a bath of oil, except for the top vertical shaft bearing and the outside pinion shaft bearing, which are grease-lubricated.

A less successful design did not provide for the upward thrust load from the force tending to separate the inner pinion shaft gear and the gear on the vertical center shaft. This resulted in abnormal bearing wear and excessive backlash on the gear teeth.

In larger mixers, it becomes feasible to use a double-motor drive; one driver at the top and the other at the bottom end of the kettle. This results in space savings at the floor level and simplified bearing and shaft seal designs, with less chance for costly repairs.

Gear reducers of untried designs should be avoided if standard production units can be applied. For agitator drives, AGMA Class II gears are generally found adequate.

Grease kettle drives are usually considered constant torque application. An exception is the processing of "cooked-in" types of greases. This is a constant horsepower application. Most modern grease mixers are of necessity capable of some variations in agitator speeds.

Some cost information and characteristics of several possible 50 hp. primary drives are shown in Table I. All of these different drives have been used. In addition, some speed change gear boxes have been used. A steam turbine drive may be attractive if the grease plant has a plentiful supply of low cost steam, say from an adjacent refinery, or where the exhaust steam is needed for low pressure heating.

Agitators

Scraper-type agitators are preferable to non-scraper types to insure reasonable rates of heat transfer, uniform mixing, and elimination of local over-heating. Time-savings possible with scraper types range up to 80% in the case of heating grease with a scraper as compared with a non-scraper.

Hinged follower type scrapers are preferable in general to leading-type. Good designs of the latter have proved reasonably satisfactory but they are often susceptible to more wear and repair costs than well-designed follower types. They have been known to score kettle walls even when the surface had been machined.

An example of a hinged follower scraper is shown in Fig. 1. In one case, eight years of service were obtained in a heavy duty mixer with no appreciable wear to scraper surfaces or damage to kettle wall. Peripheral speed is 706 fpm at high speed and 353 fpm at low. This type of scraper adjusts automatically in pressure to changes in viscosity of the vessel contents. With good shop fabrication practices, it is not necessary to machine the inner wall of the kettle to insure proper scraper action. However, careless workmanship should not be tolerated. It is reasonable to require concentricity of the inner shell of a 7½-ft. I.D. mixer to be within —0.125 in.

Double motion agitation generally has proved to be well worth the additional initial cost over single motion. Double motion in itself, however, will not insure satisfactory mixing. The thing to watch is too great a spacing between agitator bars, which allow excessive channeling during critical heavy soap stages and result in non-uniformity. Also, bars should be spirally-mounted so as to avoid intermittent loading on the driver.

Sufficient strength is needed in agitator design to resist permanent bending under the maximum torque load of the driver. For double-motion agi-

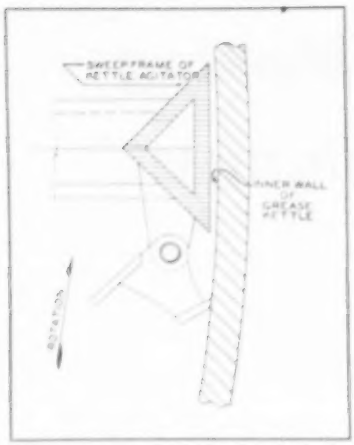


FIG. 1—How the hinged follower type scraper works

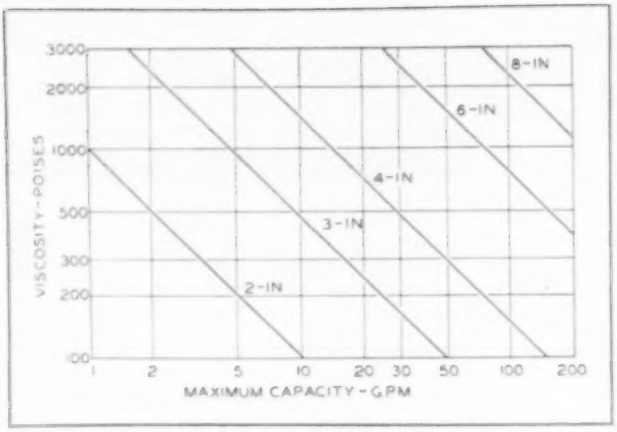


FIG. 2—Size of suction piping vs. capacity

tators, experience has shown that closely-spaced bars with only about as much space between the bars as the projected area of one of the bars in the vertical plane has been the best.

Good performance with single-motion agitators has been obtained when the bars are spaced far enough apart for the grease mass to roll through the bars and mix rather than spin with the bars.

In one successful single-motion design, the vessel was 6 ft. I.D. by 9 ft. deep on the straight side of the inner shell. Bottom head was ASME flanged and dished pattern. Agitator bars were on 24-in. centers and are made of 1 x 6 in. flat bars, pitched 45° and twisted to a reverse 45° pitch 2 ft. from the center shaft. The outer portion of the bar tends to move material upward and the inner portion tends to move it downward.

The sweep frame consists of ¾ x 4-in. flat, pitched bar attached to the horizontal agitator bars, and clearing the inner kettle wall by 1/16 in. Scrapers are hinged follower type. Agitator speeds are 36 and 18 rpm. Horsepower is 50 at either speed. The vessel is jacketed for steam at 150 psig. and alternate use of cooling water.

This mixer is an example of proper selection of grease making equipment because:

1—Several existing plant kettles could not produce the grease to be made in this equipment because sufficient control of agitating and temperature was not possible.

2—Production during the first year from the kettle was approximately 5,000,000 lb. of uniform grease meeting quality standards expected from the formula.

3—Net profit on the first year's production was 20 times the total installed cost of the kettle and all accessories.

4—No maintenance was required in eight years of operation other than routine lubrication and inspection.

The engineer who was responsible for all features of design, installation, and initial operation of this unit feels he could today select equipment with a double-motion agitator which would do even better.

Heating Systems

Jacketing is preferred to direct-firing and most recent installations are jacketed, although many direct-fired grease mixers are still in use. A typical jacket working pressure is 150 psig. With proper agitator design, good insulation, and a closed top mixer, it is possible to attain a grease temperature of 345 to 355° F. using saturated steam at this pressure.

When higher temperatures are required—up to 410° F. for some lithium greases and 500° F. for complex strontium soap types—an automatically controlled, gas-fired, steam superheater has been used. Although overall efficiency may not be particularly good, the required temperatures can be obtained and water may be used for alternate cooling.

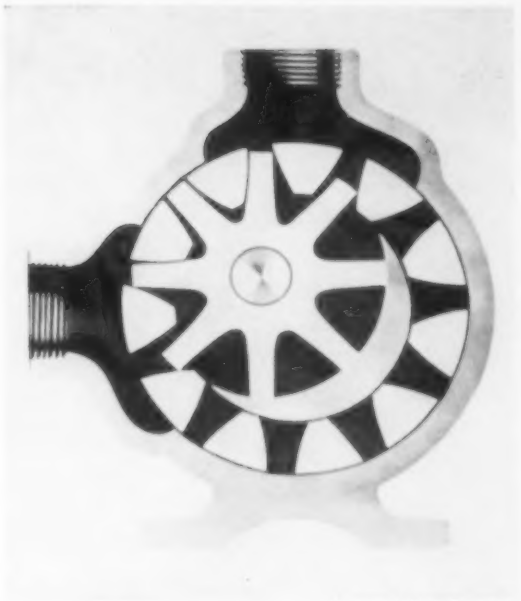
An increasingly popular heating medium is circulating hot mineral oil. A desirable heat transfer oil is one with moderate viscosity, low pour

Table 1—Comparative Costs of 50 hp. Primary Drives for a Grease Kettle

Drive	Speed Variation, rpm	Torque	Cost, incl controls
1-speed electric motor	0-1800	——	$1523
2-speed electric motor	two fixed, 1800 & 900	constant torque	$2068
2-speed electric motor	two fixed, 1800 & 900	constant h.p.	$3348
Enclosed, variable-pitch pulleys, motor, integral	infinite, 1800 to 600	constant torque	$5816
1-speed electric motor with VS hydraulic coupling	infinite, 1800 to 450	constant torque	$3560
A.C. motor, DC generator, var. speed DC drive	infinite, 1800 to 225	constant hp to 1150 rpm constant tor. to 225 rpm	$7650
Mech. drive steam turbine	infinite, 1800 to 1260	constant torque	$1350
Mech. drive steam turbine	2000 to 1000	constant torque	$2850

Courtesy Sinclair Refining Co.

FIG. 3—Cutaway view of herringbone gear pump



Courtesy Viking Pump Co.

FIG. 4—Cross-sectional view of gear-within-gear pump

point, high boiling range, and maximum resistance to thermal breakdown. One such oil is refinery recycle gas oil stock. Other heat transfer oils made up largely of aromatic or naphthenic hydrocarbons resistant to thermal breakdown are available. High viscosity, high flash point oils were used in early installations with the thought they would give protection against fires. This was fallacious, as these heavy oils were more susceptible to breakdown than other types. Furthermore, start-up may take as much as four hours as compared to one hr. for lower viscosity oil.

The expansion tank is the portion of a hot oil system that must be watched for design or engineering errors. A suitable expansion tank permits the system oil to expand with heat and it acts as a cold oil seal to prevent contact with air. In a well-designed system, this tank will be within 50° F. of the surrounding air temperature. Piping is arranged to prevent convection currents and thus heating from the high temperature part of the system.

Water cannot be used, of course, as a cooling medium in systems employing hot oil for heat. In one grease plant, satisfactory cooling rates could not be obtained for greases that had to be cooled below 140° F. when the heating oil was a 200 SSU at 100° F. material.

This problem was solved ultimately by using a thermally stable oil with a viscosity of 40 SSU at 100° F. Additional data on the oil is: flash point, C.O.C., 280° F.; Gravity, 37° API; initial B.P., 512° F., end point, 600° F.

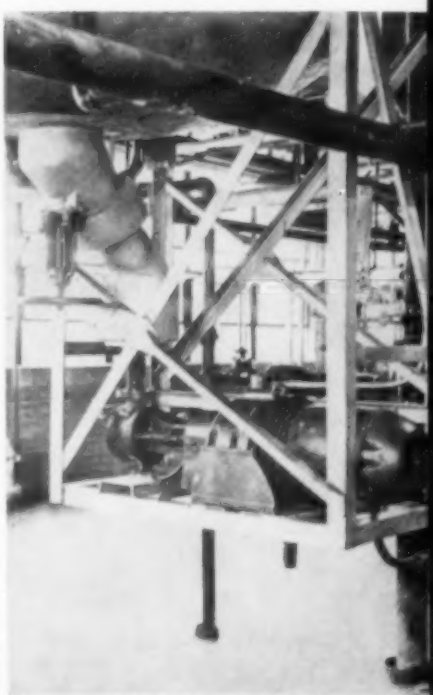
What are the relative costs of jacketed grease mixers for varying jacket working pressures? Table 2 gives some July, 1954, comparisons. These costs are for first class equipment conforming to the highest standards of the ASME-API pressure vessel code.

Table 2—Costs of Jacketed Grease Kettles
(2000-Gallon Working Capacity)

Description	Approx. Cost
Open Top, Jacket Working Pressure 75 psig.	$30,000
Open Top, Jacket Working Pressure 150 psig.	$31,000
Open Top, Jacket Working Pressure 200 psig.	$32,000
Open Top, Jacket Working Pressure 300 psig.	$34,000
Closed Top, Internal Working Pressure 150 psig., Jacket Working Pressure 75 psig.	$34,000

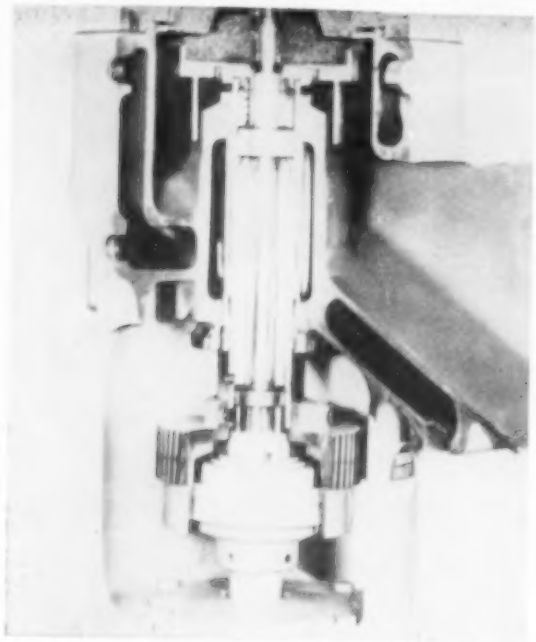
Soap Formation Equipment

For economic reasons and for quality control reasons, the lubricating grease manufacturer makes the bulk of his own soaps. Soaps are still the thickening agents of about 95% of the "greases" made today. (The word, "greases," in this case includes non-soap thickening agents.) The exception is that aluminum soaps are usually purchased.



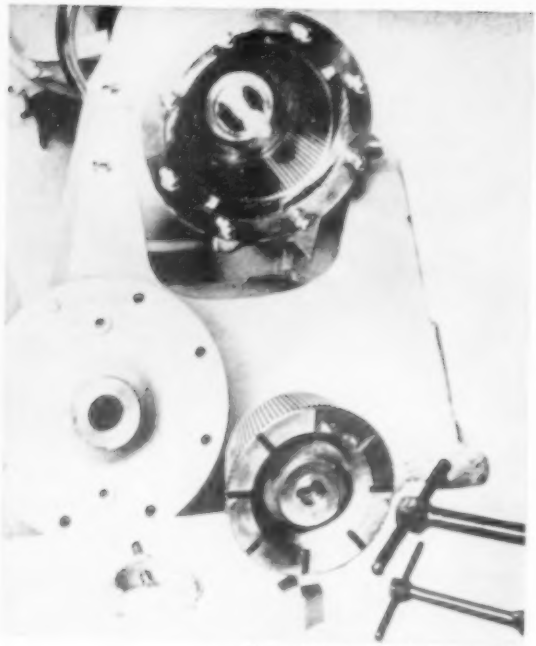
Courtesy Schutte and Koerting Co.

FIG. 5—Good practice in mounting pump under kettle



Courtesy Morehouse Industries

FIG. 6—High-speed grease mill with stone rotor and stator



Courtesy Chemcolloid Laboratories, Inc.

FIG. 7—Horizontal mill with hardened steel rotor and stator

The whole greasemaking operation may be completed in the same grease kettle whether open or closed top. In the early days of greasemaking, it was proved that there is an obvious time saving by using one soap kettle to form soap stock for two or more finishing kettles. By the use of agitating pressure vessels to form soaps, soap cooking time cycles have been reduced by as much as one to two hours compared to open kettle cooking. Cooking temperatures in these vessels range from 325° F. to 375° F. Heating is by steam or hot oil. It is necessary to provide cooling for this equipment to enable charging of successive batches.

Soap is formed in pressure cookers in a portion of the mineral oil used in the batch of grease. Soap concentration ranges from about 65% to about 35%. The finished soap stock is transferred to a paddle kettle for dehydration and finishing by the use of steam pressure built up during the cooking. The transfer piping is then purged by air or in some cases by steam.

The soap transfer line should be as short as reasonably possible and should be directly connected to the finishing kettle and not tied into the re-circulating piping on the grease finishing kettle. Two-inch steel piping has generally been found adequate for the transfer line. For safety, all valves and fittings on the transfer lines should be of steel.

To avoid non-uniformity in the finished grease, some recently designed grease finishing kettles are being equipped with flush valves part way up the side of the shell to admit transferred soap stock from the pressure cooker. This is better than admission of soap from the top of the kettle as it eliminates a former non-uniformity problem caused by hang up of high soap content material on the upper part of the agitator assembly and inside surface of the top head or cover.

Grease Pumps

You will want to avoid these typical mistakes made in selection and installation of grease pumps:

1—Excessively long suction piping of inadequate size.

2—Discharge piping too small or too long.

3—Failure to use a self-cleaning type of strainer on the discharge side of the pump rather than an ordinary screen.

4—Driving pump too fast for its design or using a pump too light in construction for heavy duty service.

5—Selecting a type which gives one or two pulses per revolution, thus causing excessive noise and vibration to piping and other equipment.

6—Not providing relief valves of close compact design.

7—Not heating lines where needed.

You will want to rely on previous plant experience as the best source of information for selecting pumps and designing piping. Quite often a few tests with diaphragm protected pressure gages on grease plant lines will give the necessary information.

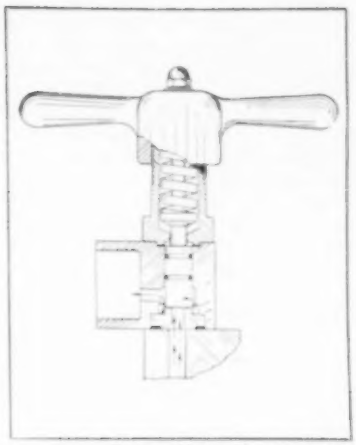
A simple formula for estimating pressure drop knowing viscosity, or for estimating viscosity for laminar flow conditions—such as found in pumping grease—has been suggested by Worcester:[1]

$$P = (27.3 \times \mu \times Q)/d^4$$

where: P = pressure loss in psi./1000 ft. of pipe.
μ = absolute viscosity, in poises (Stokes x specific gravity).
Q = quantity, in U.S. gpm.
d = actual inside diameter of pipe, in inches.

If plant test data is not available, pressure loss is sometimes estimated from data obtained with the S.O.D. pressure Viscometer. The data in Table 3 were obtained in this manner.

Piping conditions on the suction side of the pump are quite critical, because atmospheric pressure is the only force—other than slight static head pressure due to depth of grease—that



Courtesy Manton-Gaulin Mfg. Co.

FIG. 8—Internals of one stage in piston type mill

Table 3—Pressure Loss in Grease Lines Estimated from SOD Viscometer Tests

Grease Tested	Temp. °F.	Pipe Size	Flow g.p.m.	Rate of Shear Sec.$^{-1}$	Ap. Vis., Poises	p.s.i.g. Per 10 ft. of Pipe
No. 3 Li	77	2"	10	44.1	410	66
No. 3 Li	134	2"	10	44.1	305	49
No. 3 Li	134	3"	10	13.5	880	28
No. 3 Li	134	3"	40	54.0	255	33
No. 3 Li	77	3"	40	54.0	345	44
No. 2 Li	77	3"	40	54.0	228	29
No. 2 Na	77	3"	40	54.0	382	49

Table 4—Typical Successful Grease Pump Application

Type	gpm	Speed, rpm	hp	Pipe Connections	Relief Valve Setting	Application
Herringbone Gear	40	860	10	3"	225 #	Under Grease Kettle
Same	76	100	30	6"	——	Same
Gear-Within-Gear	33	150	7.5	2-½"	160 #	Same

can cause a grease to feed to a pump.

A helpful chart for selecting the proper size suction line for different capacities and viscosities when the suction line is not over five ft. long is shown in Fig. 2. A reduction factor of 5% in capacity will compensate for two 90° elbows. From the chart in Fig. 2, it is apparent why 8-in. flush-bottom valves are in common use as bottom grease outlet connections for plant kettles.

Where the process plans call for circulating the grease in the heavy soap stage during processing, plant experience indicates that for design purposes it would be well to use the maximum viscosity line in Fig. 2.

Among successful types of positive delivery pumps in use for greases are: herringbone gear, gear-within-gear, multiple and single screw, and rotating plunger designs.

One that has performed very well under grease kettles is the herringbone gear (see Fig. 3). Pumps of this type have been used at speeds up to 860 rpm on grease as heavy as it will flow to the pump. Design features which contribute to satisfactory operation appear to be venturi pattern suction and discharge ports, relief grooves which avoid entrapment of pockets of material being pumped, large sturdy shafts with short bearing spans, double helical tooth form gears, hardened gears, and a rigid case design. Such a pump will work quietly under starved suction conditions. The large number of teeth smooths out the pulsations.

Another successful type of pump—for operation at slower speeds, around 150 rpm—is the gear-within-gear (Fig. 4). An illustration of sound engineering practice in the installation of such a pump is shown in Fig. 5: the pump is on a framework under the kettle to permit a reasonably short suction line. It will also be noted that a bellows type expansion joint is used directly above the pump to prevent excessive stresses.

A few typical grease pump applications known to be successfully operating are shown in Table 4.

Milling and Deaeration Equipment

Two types of high-speed mills are in current use in many grease plants, and a third, newer type is beginning to find some usage. The internal construction of one mill which uses specially prepared stones for the rotor and stator is shown in Fig. 6. Driven by a 40 hp. electric motor, this machine rotates at 5400 rpm. Another mill is shown in Fig. 7. With a hardened steel rotor and stator, it rotates at 3600 rpm with a 100 hp. drive.

No fixed figures can be given for the capacity of either machine, because formulations vary and the intensity of milling needed for greases made in various plants also varies. For example, three different grease-making companies reported the capacity of one of these machines on an NLGI No. 2 grade of lithium grease as follows: Company A—6000 to 8000 lb/hr.; Company B—12,000 to 14,000 lb/hr.; Company C—20,000 to 25,000 lb/hr.

The new type mill, now being used successfully on non-soap type thickened lubricants, consists of a high pressure, triplex piston type pump which forces material through an adjustable opening of small size. The material flows through the opening at high velocity and impinges against a hardened alloy ring. This causes an intense action. For grease manufacture, this working is done in two stages. Pressure drop per stage is about 3000 psig. The internal construction of one of the stages is shown in Fig. 8. In a complete machine, the manufacturer reports a working capacity of 15,000 lb/hr. requires a 125 hp., 1200 rpm motor.

It should be pointed out that milling equipment is well established in modern grease plants and are necessary in processing of some greases. In the cases of other greases, mills will compensate for inferior agitation in the kettle; manufacturing time cycles have been materially improved in certain instances. In still other cases, the grease cannot be improved by milling if it has been properly processed in the kettle. Milling will not always compensate for improper processing up to the point of milling, nor will it make good products out of fundamentally inferior formulations.

Deaeration improves the appearance of grease and sometimes its storage stability. Deaeration will solve the problem of too much air. Some greases have contained so much air that they were self-energizing, and when pumped into bearing housings have flowed back out when the pressure of the filling gun was released.

Filters

The most commonly used filtration units are different sizes of an edge-type filter consisting of closely spaced discs with cleaning fingers to prevent plugging of the openings and excessive

pressure drop. For best operation, these units are motor driven at about one or two rpm.

Continuous Grease Plant Equipment

Complete and compact continuous grease-making plants are available from a number of sources for manufacture of aluminum stearate and lithium greases. These plants have been designed around a highly efficient heat transfer and mixing machine. A holding section is incorporated in the aluminum system to permit the grease to jell: this is not needed in the lithium grease system.

Specifications as reported by the manufacturer of such continuous units, The Girdler Co., are as follows. For aluminum stearate: rated capacity, 1500 lb/hr.; 70 to 75 hp. for all drives; 260 lb/hr. of 125 psig. steam (to heat slurry to 310 F.). For lithium: rated capacity, 2000 lb/hr.; 70 to 75 hp. for all drives; Dowtherm to heat the grease to 400 F. (but high pressure steam or hot oil can be used instead); 60 gpm of water at 75 F. to cool the grease (water is preferred but brine can be used).

Either plant can be installed in a space 20 x 20 ft. by 10 ft. high. Overall heat transfer coefficients will range from 100 to 250 Btu/hr./sq. ft./°F.

Materials Handling

As the materials other than mineral oils which make up the finished grease amount to only about 10% of the product, on the average, it could be expected that handling of these materials should not be a major problem.

In an efficient modern plant solid materials such as hydrated lime, fillers, and flaked or beaded high titer fats and fatty acids are best handled in multiwall paper bags. The pallet system of handling has been found workable.

Pamphlets giving excellent advice on the handling and storage of liquid and semi-solid fats and fatty acids are available from many of the suppliers of these materials. To avoid contamination, a completely isolated system consisting of a separate tank, pump, weigh tank and piping should be provided for each separate material. In plants where this simple rule was not followed, a tremendous amount of difficulty has been encountered.

While a slight amount of contamination among some of the mineral oils used may not be as serious as contamination involving fats and fatty acids, the same general rule should be used in handling mineral oils.

While provision should be made for very accurate weighing of all soap forming ingredients, either weigh tanks or meters have been found satisfactory for measuring oils into grease finishing kettles. While weighing of the mineral oils is inherently more accurate, it is questionable in many cases if the extra expense for the weighing installation is justified.

Studies in some grease plants have indicated that container storage, preparation, filling, and handling can amount to the largest item of labor expense. Bulk handling of finished greases has materially reduced costs in plants handling large volumes of greases. An excellent discussion of bulk handling and other solutions to materials handling problems in packaging grease has been published in *The Institute Spokesman*.[2]

Bulk handling of grease has been found successful for greases as heavy as No. 2 N. L. G. I. grade. By this means, the handling expense has been reduced considerably, since a completed batch in a kettle can be drawn immediately, at any time of the day or night, to the storage tank. This leaves the kettle available for starting another batch. Then the grease in bulk storage tank can be drawn into packages to fill orders when most convenient. Thus the drawing crews can be kept busy without any intervals of waiting for any particular batch of grease to be completed. Also, inventory of packaged greases may be kept at a minimum.

The Completed Plant

A successful grease manufacturing operation is possible only if the equipment is good and the complete installation carefully planned. Successful operation and good housekeeping begin on the drafting board.

The Pilot Plant

As it seems logical to make mistakes on as small a scale as possible, the lubricating grease industry may find it advantageous to do more exploration on a pilot scale. Some companies are now doing interesting development work on a small scale. It is probable that improved equipment and thus methods of processing greases will result from this work.

Increased labor costs are being faced in all manufacturing industry and the lubricating grease industry is no exception. Man has been rated mechanically at about ⅛ horsepower. The cost of ⅛ horsepower-hour (one manhour) of mechanical work done by man is about $3.00 in production work. If an electric motor can be installed to do this work, on the basis of an electrical energy charge of 2 cents per kilowatt-hour, the same amount of mechanical work will cost about ½ cents.

It is thus understandable that grease manufacturers are finding it necessary to eliminate hand labor where possible. The writer believes that this trend will continue, and that the manufacturer who can most successfully apply mechanical equipment will enjoy a distinct advantage.

The preceding article consists essentially of a paper, "Selection of Equipment for Successful Operation of a New Grease Plant," presented by Mr. Yarham at the 22nd annual meeting, National Lubricating Grease Institute, San Francisco, Calif., October, 1954.

Meet the Author

O. L. Yarham, supervisor of the lubricating grease research group, East Chicago Laboratory, Cities Service Research and Development Co., has been associated with the firm since 1950. Prior to that, he was a research chemical engineer on lubricating grease development for the Battenfeld Grease and Oil Corp., Kansas City, Mo., from 1944 to 1950.

A graduate of the University of Kansas, with a B.S. in chemical engineering in 1940, Mr. Yarham was in chemical engineering research work for the U. S. Dept. of Agriculture regional research laboratories at Peoria, Ill., and Wyndmoor, Penna., before joining Battenfeld. He was elected to membership in Sigma Tau at Kansas U. in 1938.

Bibliography

(1) Worcester, William E., "Pumping Viscous Materials," *The Petroleum Refiner*, February, 1950.

(2) Lueth, Paul E., Jr., "Materials Handling in Lubricating Grease Packaging Operations," *The Institute Spokesman*, April, 1952.

For better processing . . .

Try Cascade Controls

- Direct Control
- Indirect Control
- Ratio Control
- Combined Ratio-Cascade
- Programmed Control
- Computer-Analyzer Control

By HARRY J. HARTZ
Application Engineer
Minneapolis-Honeywell Regulator Co.*

CASCADED control systems are coming into greater use every day with the trend toward automatic operation in refineries and other process industries. They will continue to grow in importance with the advent of more highly developed product-quality control mechanisms.

Infrared analyzers, ultrasonic and dielectric devices to determine product quality all serve to widen the field for cascade control instrumentation.

Factors which have emphasized the need for more complex controls of the cascade type are:

Closer process variable regulation, necessary to fulfill the need for higher quality products and increased throughputs, often when using existing and unmodified equipment.

Increased theoretical knowledge of many industrial reactions permits the use of new and unfamiliar variables for the control of these processes.

The complexity of new processes has increased the difficulty of keeping them under adequate control, and many demand more accurate and dependable control systems for profitable operation.

Cascade control is not a new development since it has been applied in several forms for a number of years. As the need for its application increases, however, it becomes imperative that a thorough understanding of its underlying principles is set forth.

What Is Cascade Control?

A cascade control system can be defined as one in which two or more related variables are interlocked in a single control loop. Usually, one variable is subordinate to the other and so they are classified as the primary and secondary elements in the system.

The primary variable governs the operation of the portion of the process to which the system is applied.

Secondary variable changes affect the primary variable. The magnitude of this effect will be dependent upon the characteristics of the process, the sensitivity of the primary variable to small changes in the secondary variable, and the time lag between a change in the secondary variable and a corresponding shift in the value of the primary variable.

The greater the sensitivity of the primary variable and the larger the lags in the process become, the more important it is that cascade systems be used. In such systems, not only is each variable controlled independently, but the two are linked together to provide an integrated control effort.

Applying Cascade Control

In an oil cracking furnace one of the primary variables is the oil temperature as it leaves the heating coils. This temperature is dependent upon secondary variables such as the oil charge rate, the furnace efficiency, the fuel flow rate, the fuel composition or heating value, and the fuel pressure.

Not all of these elements can be included in a single control system. Some of them, the oil charge rate, for instance, can be maintained constant by a separate control system. Others, like the furnace efficiency, can be depended upon to change only slowly.

Changes in uncontrolled variables such as fuel pressure or composition, however, will cause immediate changes in the heat input to the furnace which will result in a fluctuating output temperature.

Controlling the fuel flow rate as shown in Fig. 1 will tend to reduce fluctuating output temperature, but cannot eliminate it completely. On the other hand, controlling the fuel valve directly by the temperature controller as shown in Fig. 2 eliminates the possibility of maintaining the fuel flow rate constant in the face of fluctuating fuel line pressures.

If the fuel flow controller is reset by the oil outlet temperature, the fuel flow could be varied to compensate for changes in oil outlet temperature while being held stable by the flow controller. This cascade control system is shown in Fig. 3. Outlet temperature is the primary variable and fuel flow is the secondary variable.

A cascaded system of this type combines the advantages of a stabilized fuel flow and the maintenance of a direct relationship between oil outlet temperature and heat input to the furnace.

Note that any process change which can be compensated for by a change in the fuel flow rate will be taken care of by this system. For instance, if the furnace throughput is increased, the resultant drop in output temperature will call for an increased fuel flow for the increased heat requirement.

This system has a serious disadvantage because of the lag between the time the throughput is changed and a corresponding change in output temperature is detected.

Closed Loop Control

As mentioned above, a cascade control system of this type utilizes both a temperature and a flow controller.

The control settings for these instruments are determined by the requirements of the portion of the process to which each instrument is related. Each controller exists as a part of a closed control loop.

In Fig. 1 the control loop in the

*Since writing this article, Mr. Hartz has become associated with the Conoflow Corp. of Philadelphia, Pa. as a sales engineer.

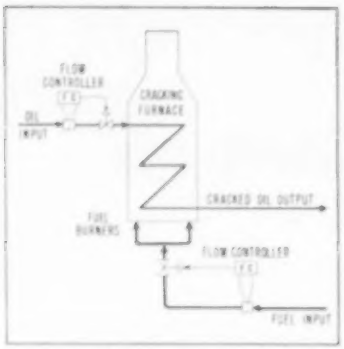


FIG. 1—DIRECT CONTROL of fuel flow rate by flow rate controller

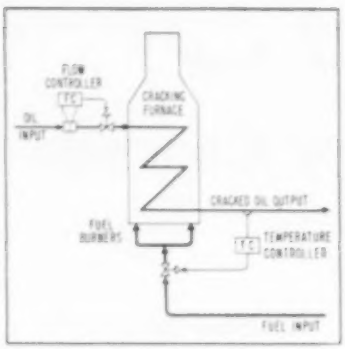


FIG. 2—DIRECT CONTROL of fuel flow rate by oil outlet temperature

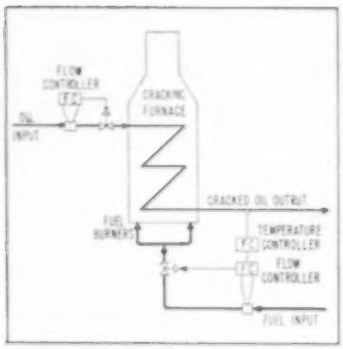


FIG. 3—INDIRECT CONTROL of fuel rate by oil outlet temperature reset

fuel system consists of the fuel line, the orifice or sensing element, the flow controller, and the final control element or valve.

In Fig. 2 the temperature control loop consists of the burner and furnace, the temperature-sensing element, the temperature controller, and the valve. Each is a basic control loop.

A more complex loop is illustrated in Fig. 3. The temperature control loop governs the primary variable and it includes the flow control loop. The flow control loop is subordinate to the temperature system.

The primary control loop which includes the whole heating process will determine the settings of the temperature controller. The secondary control loop includes only the fuel line and only this portion of the system will determine the control settings required by the flow controller.

Under no circumstances should the controller settings be adjusted to set the relationship between the two variables. This function is accomplished by an additional set of adjustments within the cascade control instrument.

The Resetting Function

In cascade control loops, the output of the primary controller, instead of positioning a valve, repositions the set point of the secondary controller. Therefore, a change in the value of the primary variable will cause a change in the output of the primary controller which then resets the value of the secondary set point. The secondary controller will then control the secondary variable to this value.

It would be difficult to find a term better than "resetting" for this function. However, this should not be confused with the reset adjustment on the controller itself which performs an entirely different function.

In a standard instrument having an index-setting device for cascade control, the amount of set point change which will result from a given change in the primary controller output signal can be varied by means of the "zero" and "span" adjustments. These relationships are shown in Fig. 4.

Span Adjustment

The span adjustment determines the amount of change in the secondary set point which will result from a unit change in the signal from the primary controller.

At a 50% span setting, for example, the set point will change by 50% of the scale as the primary controller output changes over 100% of its range. The range for a typical cascade instrument is from 0% to 200%.

Fig. 4a shows the relationship between primary controller output pressure and the secondary set point for spans of 25%, 50%, 100% and 200%. The vertical scale is calibrated from 3 to 15 psi since this is the normal full scale operating range of controller output pressures.

Zero Adjustment

The zero adjustment may also be called a suppression adjustment since it determines at what point on the scale the set point will start its movement. Zero adjustment may be made in either a positive or negative direction as shown in Figs. 4b and 4c.

With a span adjustment of 25%, for example, the zero adjustment can be set so that for a full scale change in primary controller output, the secondary set point value will vary from 0% to 25%, 15% to 40%, 60% to 85%, or over any other 25% increment of the range. Typical zero adjustment settings are ±100%.

For a negative zero setting, the secondary controller set point will remain at zero until the primary controller output pressure moves upscale by an amount dependent upon both the zero and span settings. This can best be seen by referring to Fig. 4c.

The dotted portion of each curve represents the time during which the secondary controller set point remains at zero. This occurs because the secondary controller set point value cannot drop below zero. Where each curve crosses zero percent of full scale, the secondary controller set point will begin to follow the primary signal.

At a 100% span setting and —25% zero setting, for example, the secondary set point will not move upscale until the primary output pressure exceeds 6 psi. From that point on it will increase with the primary variable at an equal rate. The rate of change of the secondary set point with changes in primary output pressure depends upon the span settings, which determine the slopes of the Fig. 4 curves.

Ratio Control

Still another approach to the problem of furnace temperature control is illustrated in Fig. 5. This system uses a specialized form of cascade control known as ratio control.

Ratio control in this system is based on the assumption that in maintaining a constant outlet temperature, the fuel requirements are governed directly by the oil flow through the furnace.

Note that the furnace throughput is now uncontrolled and a flow transmitter replaces the flow controller. The transmitter output resets the fuel flow controller directly.

An arrangement of this type assumes that all other factors affecting the outlet temperature will remain constant since this system does not actually measure outlet temperature. **This is an open-looped cascade** control system because the variable of primary interest, outlet temperature, is not a part of the control loop.

The cascade systems in Figs. 1 and 3 were closed loop since temperature

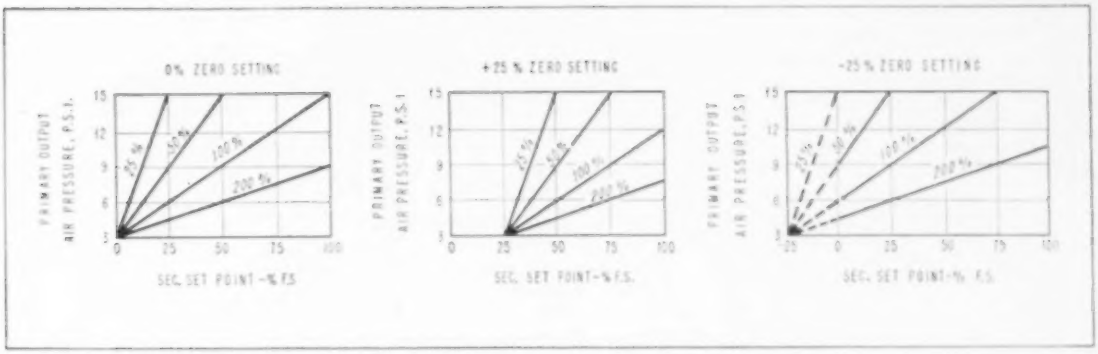


FIG. 4—ZERO AND SPAN ADJUSTMENT effects on Cascade Controllers

was measured and fed to the control loop to influence the system directly.

With a standard ratio controller, a change in signal from the primary transmitter will cause a corresponding change in the set point value of the secondary flow controller. The secondary controller then maintains its flow at the new value dictated by the primary transmitter. This maintains a constant ratio between flows.

Two extremes of ratio with a typical instrument are shown in Fig. 6. In Fig. 6a, a 25% ratio is set as the primary signal changes over 100% of the scale. The secondary set point follows at one-fourth rate and traverses a total of only 25% of full scale.

In Fig. 6b, a 200% ratio is called for and the secondary set point changes at twice the rate of the primary signal. Therefore, the secondary set point has traveled full scale by the time the primary signal has changed by only 50% of its scale.

Ratio Definitions

It is important to remember that in practice the true controlled ratio is a function of the basic system ratio and the ratio setting of the instrument.

The basic ratio of a system of two flows is the ratio between their maximum flow rates when the system is operating at design conditions. These flow rates are dependent upon pipe and valve sizes, the fluid, the pressures, and the orifice plate sizes.

The basic ratio may be calculated most easily by taking a ratio between the full scale chart values of the two flows in question.

The instrument ratio determines the relationship between the primary input signal and the corresponding change in the secondary set point. This value is set on the instrument ratio scale as shown in Fig. 6.

The actual controlled ratio which will be maintained between the two flows is equal to the product of the basic ratio and the instrument ratio.

At an instrument setting of 100% ratio, the system will be controlled at the basic ratio. At a 50% ratio setting on the instrument, the system ratio will be maintained at one-half the value of the basic ratio.

Only the controlled ratio is a true indication of how much the secondary flow will change for a unit change in the primary or uncontrolled flow.

Ratio Control Advantages

Since the ratio control system is applied to the input streams of a process, any changes or variations are detected and corrected before the process is affected adversely. With this system, process lags can be side-stepped and immediate control action results from any changes in the inflowing streams.

In a standard temperature control system, as illustrated in Fig. 3, a change in oil charge rate would not be compensated for until a corresponding change in outlet temperature occurred. Depending on the magnitude of the process lags, the effect of changes in throughput may not be felt for a significant period of time.

By the time correction action can be taken, new changes in input conditions may have occurred. As a result of this loose control, the output temperature may cycle through wide limits.

With a ratio control system as illustrated in Fig. 5, changes in throughput cause immediate and corresponding changes in the fuel flow rate, thereby

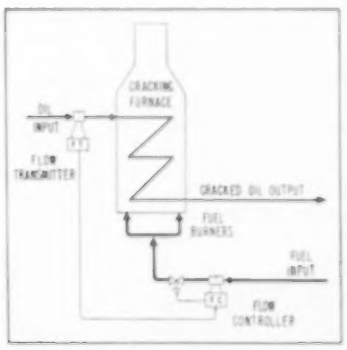


FIG. 5—RATIO CONTROL of fuel flow rate by oil input flow rate

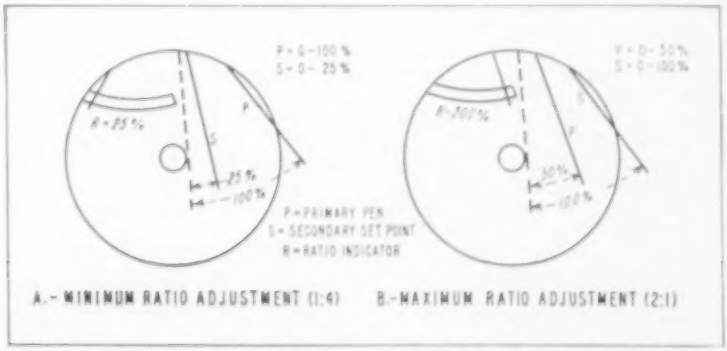

P = 0 - 100 %
S = 0 - 25 %
R = 25 %
25 %
100 %
P = 0 - 50 %
S = 0 - 100 %
R = 200 %
50 %
100 %
P = PRIMARY PEN
S = SECONDARY SET POINT
R = RATIO INDICATOR
A.- MINIMUM RATIO ADJUSTMENT (1:4)
B.- MAXIMUM RATIO ADJUSTMENT (2:1)

FIG. 6—RATIO ADJUSTMENT settings for minimum and maximum values and their resultant control of the Ratio Controller operation

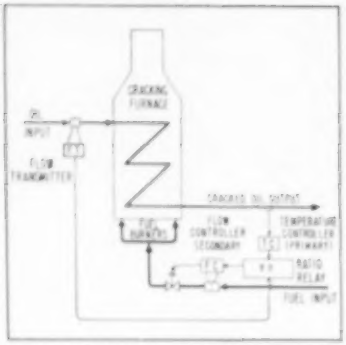


FIG. 7—COMBINED RATIO-CASCADE CONTROL of fuel flow rate

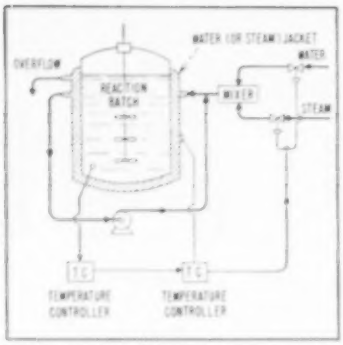


FIG. 8—DIRECT CONTROL of jacket temperature by batch temperature

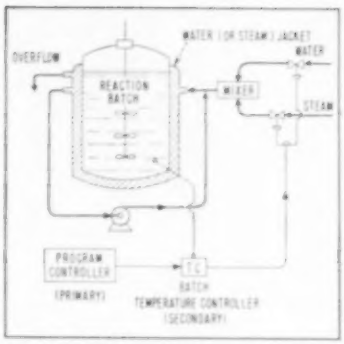


FIG. 9—PROGRAM CONTROL of batch reaction temperatures with jacket

avoiding cycling temperatures resulting from such upsets.

Open versus Closed Control Loops

It is important to remember that ratio control as defined above is basically an open-loop system in which no feedback signal is used to determine the effect of maintaining the two flows at the preset ratio.

This system cannot compensate for changes in the quality (i.e. temperature or composition) of either of the flowing materials, but can correct only for changes in the pressure drops measured across the primary elements.

Referring to Fig. 5, a change in any variable except the two flows will result in a change in output temperature that cannot be corrected by the ratio control system.

In basic cascade control systems the primary variable, the one whose control we are vitally concerned with, is monitored and its value is fed back into the system as a measure of the deviation from the desired control point.

Closed loop systems of this type lend themselves to the most accurate control since the feedback signal permits the system to readjust itself continuously until the desired value of the controlled variable is obtained. As a result, only in the primary measuring element is accuracy and reproducibility of importance.

Errors in the other components of the system are of no consequence since the system will readjust itself to compensate for any such inaccuracies until the system as a whole has balanced itself at the desired set point.

Another way in which ratio control differs from cascade control is in the use of controllers. A ratio control system uses a control unit on only one of the two variables involved in the system. When ratioing two streams, one is allowed to flow uncontrolled and its rate is transmitted to the secondary controller to reset the set point.

In a cascade control system, both variables are under control with the output of one controller resetting the secondary set point as described above.

The ratio adjustment for a ratio control system corresponds to the span adjustment described above for cascade control. There is no corresponding zero adjustment, however.

Combined Ratio-Cascade Control

It is possible to combine the desirable features of both ratio and cascade control systems by using an additional piece of equipment known as a pneumatically-set ratio relay.

With a relay installed as part of the control system, shown in Fig. 7, both outlet temperature and oil charge rate will have an effect on the set point of the fuel flow controller.

This relay permits the use of the ratio control system described above with the addition of the feature that the ratio between the oil charge rate and the fuel flow rate can be changed pneumatically according to the requirements dictated by the temperature controller.

Adjustments can be made to the relay actuation so that the proper relationship between the two flows and the temperature can be set according to the system requirements.

It is important to note that the addition of the relay permits the positioning of a single final control element by three separate but interrelated variables; the oil rate, the fuel rate, and the furnace output temperature.

Combined System Advantages

As pointed out above, the addition of the relay permits the closing of the control loop so that the advantages of a ratio control system may be combined with those associated with closed loop operation. Variables such as fuel composition or furnace efficiency will be corrected since the output temperature signal—the primary variable—feeds back to the control loop.

An additional advantage accruing from the use of the combined system is the elimination of the control lag which normally would exist for changes in oil charge rate. The ratio portion corrects the fuel rate immediately for changes in oil flow rate.

Using only the temperature controller, there would be a considerable lag between the time the oil rate changed and the time the temperature deviated from its set point as a result.

Cascade Variations

Thus far we have dealt only with the control of an oil cracking furnace. This illustrated the ways to approach the problem of temperature control.

No one system is correct for all applications. The choice will depend upon the number of variables to be controlled, the individual process characteristics, and the economic return.

Returning to simple cascade systems, Fig. 3 shows one where temperature resets flow. In many cascaded systems, flow is set as the secondary variable.

A cascade system can be set up for any process in which one variable, the primary, must continuously govern the set point value of a second variable, the secondary, in order to maintain adequate control.

Fig. 8—showing a water-jacketed batch reactor—illustrates the primary variable of batch temperature resetting the secondary variable of jacket temperature.

As the batch temperature varies, due possibly to an exothermic reaction within the batch, its controller will reset the control point for the jacket water temperature to hold the batch temperature to a preset value.

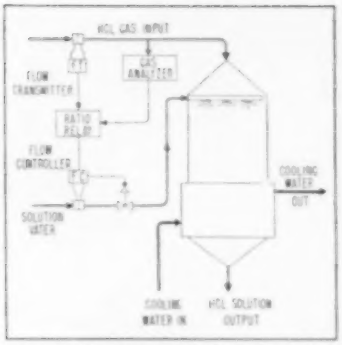


FIG. 10—COMPUTER-ANALYZER control of HCl tower absorption water rate

In the system shown, split-range valves are used to control the flow of steam or water to the jacket, thereby permitting either the addition or removal of heat from the batch.

Program Control

When sufficient knowledge of the process is available, it is frequently possible and sometimes necessary to set up open-loop cascade control.

Usually, open-loop control is needed when a critical process variable is not held constant over a period of time, but must be varied according to a predetermined schedule.

A program transmitter can be made to transmit a signal to change the secondary controller set point in a way analogous to the function of a primary controller.

The closed automatic control loop becomes the secondary control loop in this application since its action is dictated by the program transmitter which acts as the primary unit. The over-all system is considered to be open-looped since the program transmitter receives no feedback signal indicative of process conditions.

For a programmed control, it must be possible to calculate in advance the relationship existing between the variables to be controlled.

A programmed system is shown in Fig. 9 where the batch temperature is controlled according to a prearranged schedule by a time-pattern transmitter. This transmitter continuously resets the control point of the batch temperature controller.

From a prior knowledge of the process characteristics, it is possible to cut a cam which will change the batch temperature set point mechanically according to the process requirements.

In applying open-loop cascade systems of the type illustrated in Fig. 9 it should be remembered that the response time of the secondary control loop must be faster than the changing demands impressed upon it by the program transmitter. Otherwise the secondary control loop will not be able to keep up with the changes required of it by the primary transmitter.

Computer Control

The pneumatically-set ratio relay can also be used in open-loop ratio control systems.

An arrangement of this type may be justified when the effects of several interrelated variables on the upstream side of a process must be impressed on one final control element.

Fig. 10 shows an absorption column for the production of hydrochloric acid by absorbing HCl gas in water.

If pure hydrogen chloride gas was fed to the top of the column, a fixed ratio between gas and water could be set up so that a constant density hydrochloric acid would be produced although the gas flow rate varied. This assumes constant tower efficiency.

If the gas stream was not 100% hydrogen chloride, however, it would be unsound to ratio the water flow rate to the gas flow rate. A continuous gas analysis could overcome this difficulty so that the water rate could be varied according to the flow of HCl.

The instrumentation system shown in Fig. 10 performs this function. The gas flow transmitter measures the total flow and the analyzer determines the per cent of HCl in the gas.

The pneumatically-set ratio relay multiplies these two signals and its output, which is proportional to the product, is equivalent to the total flow of hydrogen chloride to the tower.

In this system the relay is used as a simple computer since it is calculating the flow of HCl from the gas analysis and total flow signals fed into it.

The computing relay output resets the water flow controller in accordance with the ratio requirements of the absorption system. The system is open-looped since the resultant of the process, HCl strength, is not fed back to the instrumentation system.

In this application with ratio control, changes in gas composition are compensated for immediately.

In a closed-loop system, such changes would first have to be detected as changes in product quality before corrective action could be taken. Depending upon the amount of tower holdup, considerable time might elapse between cause and effect thereby making the control problem difficult.

System Requirements for Cascade Control

Before any cascade control can be applied to a specific process, three basic requirements must be fulfilled:

1. The variables the cascade system controls must be interdependent.
2. The purpose of the control system should be to reduce the effect of changes in the secondary variable or to decrease the time lag of the system between any load change and the corrective action taken by the system.
3. In ratio control systems, a fixed mathematical relationship must exist between the two variables.

When Not to Use Cascade Control

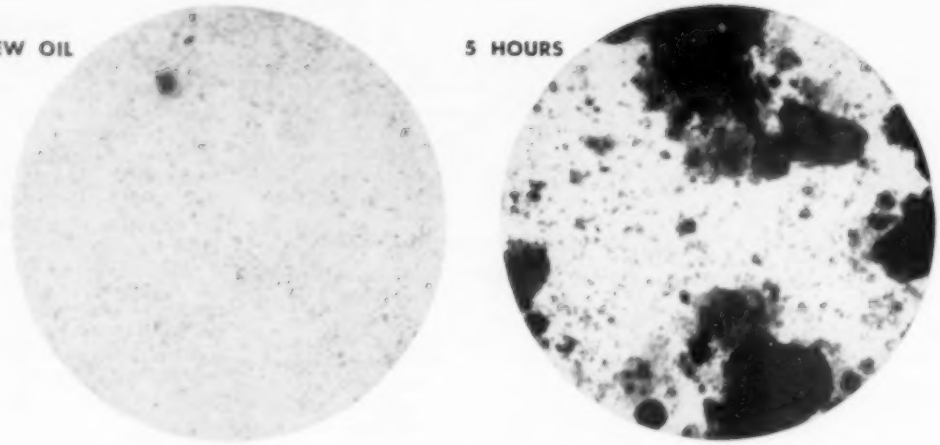
In many cases, cascade control systems may be unwarranted or undesirable for the following reasons:

1. Cascade control may offer no advantage if the primary system is a fast-responding control loop which can sense quickly any changes in the secondary variable.
2. The relationship between the two variables may be too remote. The lag and dead time existing between the two variables should not be in excess of what the cascade system can handle.
3. Results gained by cascade control may not justify the additional cost.

Mr. Hartz

Meet the Author

Mr. Harry J. Hartz received his chemical engineering degree at the University of Pennsylvania in 1948. He spent three years in the Research and Development division of Atlantic Refining Co. in Philadelphia and three and one-half years with the Brown Instrument Division of Minneapolis-Honeywell Regulator Co. in charge of instrument application engineering for the petroleum industry. In 1954 he joined the Conoflow Corp. of Philadelphia as a sales engineer. He is a member of the American Institute of Chemical Engineers, the Instrument Society of America, and the American Petroleum Institute.



HOW SLUDGE FORMS in an engine crankcase is shown in this series of electron

A New Type of Oil Additive to

A NEW motor oil detergent additive especially developed for checking the formation of sludge in engines in the stop-and-go driving typical of most passenger car operation today has been developed by Du Pont researchers. The new detergent is also claimed to be effective in the presence of engine coolant leakage into the crankcase and of aqueous blowby condensate in the oil, other features of low-temperature engine operation. It is for use in gasoline engines in all driving temperature ranges, but not in Diesel engines.

The additive base is an entirely new material in commercial detergents, although some oil companies have carried on experimental work with this or related compounds. It is a copolymer of laurylmethacrylate and diethylaminoethyl methacrylate. The detergent is an ashless, viscous, straw-colored liquid which is added to the oil in the amount of 1 to 2%.

The chemical structure and physical properties of the two grades now being marketed (564 and 565) are shown in accompanying table. They were described and their effectiveness compared with other types of detergent additives in a report before the recent annual meeting of the Society of Automotive Engineers in Detroit.* The discovery of this new class of detergents, the nitrogen containing polymers, was first reported by the Du Pont investigators in 1954.

The mechanism of detergency in lubricating oils was investigated quite extensively by Du Pont, using the electron microscope, and was explained in the current report:

"Materials which function as detergents in lubricating oil must possess at least one polar and one non-polar group. The non-polar group provides oil solubility for the molecule, while the polar group is of such a nature that it is attracted to the particles of sludge. These detergent molecules tend to cluster together to form micelles (colloidal particles) containing many molecules.

"One way in which a detergent functions is by keeping sludge particles in suspension. The available evidence indicates that the detergent molecules or micelles orient themselves around the sludge particles which develop in the oil and that this coating of detergent prevents the particles from agglomerating. During the service life of the oil, the number of sludge particles gradually increases, while the number of unattached detergent molecules or free-floating micelles decreases.

"The sludge particles may or may not possess an electrical charge attributable to the detergent. There is some disagreement in the literature as to whether these charges are responsible for the stability, or lack of stability, exhibited by the sludge dispersions."

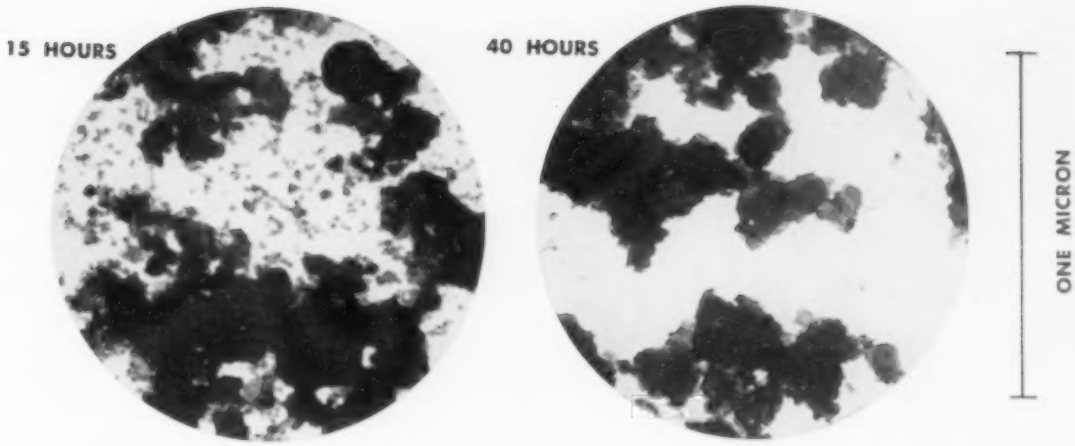
From electron microscope studies of oil samples containing 0.5% active ingredient of a barium petroleum sulfonate from a passenger car engine operated in the laboratory, it was shown that, as small particles of sludge are formed, the micelles of detergent cluster around each particle and tend to keep them dispersed. As the oil continues in use, the micelles are gradually depleted and agglomeration of particles proceeds. An example of this progression is shown in the series of four electron photomicrographs above, which show barium petroleum sulfonate micelle depletion in oil samples taken from a multicylinder engine test.

Some detergents studied were found capable of keeping the size of sludge particles so small that, for all practical purposes, the particles remain in solution. "This solubilization of sludge is the most effective way in which a detergent can function," it was stated. "As has been shown . . . engine sludge in suspension in the lubricating oil does not tend to deposit on engine parts until the concentration becomes excessive. The deposition tendency of the sludge is reduced if the sludge is solubilized by the detergent."

These concepts were inadequate, however, when it came to explaining the differences in performance of detergents under low or moderate temperature operating conditions in laboratory engine tests and road tests. For this reason the Du Pont investigators conducted bench and engine tests with representative samples from four different classes of detergents having known differences in low temperature performance.

The detergents studied were a basic

* "The Control of Low Temperature Sludge in Passenger Car Engines," by R. L. Willis and E. C. Ballard, Petroleum Laboratory, E. I. du Pont de Nemours & Co. (Inc.); Annual Meeting, Society of Automotive Engineers, Detroit, Jan. 10-14, 1955.



photomicrographs (38,000X), which guided du Pont researchers in developing . . .

Control Low-Temperature Sludging

barium phenate, a basic barium petroleum sulfonate, a metal-containing experimental detergent and a nitrogen-containing polymeric detergent, a copolymer of lauryl methacrylate and diethylaminoethyl methacrylate. The sulfonate and phenate selected had the best low temperature laboratory engine test of the 5 or 6 in each class which had been previously investigated.

The bench tests included studies of the relative ability of the four types of detergents to suspend sludge and also carbon. On this latter point the report stated: "In addition to the organic sludge which must be kept dissolved or in suspension, carbon from partially burned fuel must be prevented from depositing in the lubrication system . . . The performance of detergents in the presence of water is considered to be important because water is present in crankcase oils during low temperature engine operation. This water enters the crankcase either as condensate from blowby gas during engine operation or as a condensate which forms as a result of engine breathing during periods in which the engine is not in operation." The presence of water from either cause, it was pointed out, tended to neutralize the effectiveness of the detergent oil. The nitrogen-containing polymers were found to have superior qualities in these tests.

The ability of the detergents to prevent the agglomeration and precipitation of sludge formed during the oxidation of lubricating oils was also studied. While oxidation was not extensive in these tests, examination of the oxidized oils under the electron microscope did show, it was reported, that the type of detergent present exerts considerable influence on the nature and extent of sludge formation. "This study also demonstrated that water increases the rate at which sludge develops."

The data from bench and laboratory engine tests indicating that considerable differences in low temperature performance exist among different types of detergents was substantiated by road tests, involving country, urban and suburban driving. In general the results agreed with the laboratory engine tests. Other conclusions of the Du Pont research staff as reported are:

"Detergents which are effective at high engine temperatures are not necessarily effective at low engine temperatures.

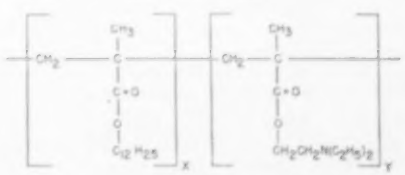
"Bench tests show that many detergents lose their effectiveness when evaluated in systems containing small amounts of water. The performance of detergents in low temperature engine service is believed to be related to their sensitivity to water.

"Bench tests and analytical data from used engine oils indicate that the benzene insolubles and the insoluble resin content of used oils is influenced by the type and the amount of detergent in the oil."

Typical Physical Properties of the New du Pont Lube Oil Additives 564 and 565

	LOA 564	LOA 565
Viscosity at 210° F., SUS	1200	3100
Viscosity at 100° F., SUS	9000	25,000
Density, lbs./gal.	7.5	7.5
Color, NPA	1—	1—
Pour Point, °F.	—10	10
Flash Point (C.O.C.), °F.	380	380
Fire Point (C.O.C.), °F.	420	420
Total Acid No., mg. KOH/g.	0.0	0.0
Total Base No., mg. KOH/g	8.0	8.0
Ash, wt.—%	0.00	0.00

Structural Formula



A PANEL OF PROCESSING TECHNOLOGISTS who bring you with the aid of a wire recorder . . .

Technical Tips on

Petroleum Processing Problems

CAN you use technical hints and practical know-how as an aid to your every-day plant operations? Confident that the answer is an overwhelming "yes," the editors of PETROLEUM PROCESSING are pleased to present for the second consecutive year a series of questions and answers on virtually every type of problem.

As in 1954, this information has been obtained by means of a wire recording of dozens of questions and answers covered during a popular day-long session at a regional meeting of the Western Petroleum Refiners Association in El Dorado, Ark., last October.

Several hundred refiners stuck to their chairs throughout this session, hearing answers to prepared questions —and to more that popped up from the floor—being adroitly handled by a panel of ten technologists.

Wide experience, from five different refining companies and five suppliers of engineering services, was represented by this panel. The moderator was E. A. Heike, chief engineer, Premier Oil Refining Co., Ft. Worth, Texas, who repeated his role from the previous year.

The refining group included: J. M. Brown, assistant manager of operations, Pan-Am Southern Corp., El Dorado, Ark.; R. E. Feasel, supervisor of fuels manufacturing, Deep Rock Oil Corp., Cushing, Okla.; J. A. Gearhart, process engineer, American Liberty Oil Co., Mt. Pleasant, Texas; and R. S. Wilson, chief chemist, Lion Oil Co., El Dorado, Ark.

The engineering group consisted of: J. G. Eckhouse, sales engineer, Universal Oil Products Co., Des Plaines, Ill.; O. D. Edwards, sales engineer, Perco Division, Phillips Petroleum Co., Bartlesville, Okla.; D. E. Norris, commercial development engineer, Houdry Process Corp., Philadelphia, Pa.; F. D. Parker, western manager, Chemical Plants Division, Blaw-Knox Co., Tulsa, Okla.; and C. W. Rippee, president, Electric Process Co., Summit, N. J.

Problems discussed included many of the same kind that were covered in the 1953 WPRA sessions and published in PETROLEUM PROCESSING during 1954 (April, pp. 529-533; May, pp. 688-690; June, pp. 888-890; July, pp. 1059-1061). Subjects receiving attention were catalytic cracking, catalytic reforming, corrosion and erosion, coking, fractionation, alkylation, sweetening, and miscellaneous plant kinks.

This month's article like last month's (pp. 366-369) comprises a number of questions and answers of a general nature. Future articles will cover the balance of the discussions. It is perhaps interesting to point out that your 1955 series will consist of an estimated 100 questions and over 200 answers. Last year's series had 77 questions and 115 answers.

What is the experience of others, and the cost involved, in combatting corrosion of steel reboiler tubes for protection against carbonic acid in steam condensate?

Edwards: The refinery people at Sweeny had a relatively severe carbonic acid condition in the steam condensate. In the heating equipment, where the condensate was discharging well above atmospheric pressures, we solved the problem by installing a small vent connection in the tube channel head just below the center cross-baffle in the condensate area. About a $\frac{1}{64}$-in. orifice was installed in the vent connection to the atmosphere.

For heating equipment discharging condensate at just about atmospheric pressure, we have used another method, which is injecting octadecyl amine ("Nalco No. 35 FM"). That answered the problem quite well, but if you have hydrocarbon present in the steam, it will of course dissolve the amine and carry it away, making the treatment no good.

We have both categories of equip-

*Left to right: Parker, Eckhouse, Norris, Rippee, Heike, Brown, Feasel, Gearhart, and Wilson. (Edwards was not present for the picture.)

ment. We have tried acidizing and stripping the boiler feed makeup water after water treatment, but results were not very well known, the treatment was pretty erratic, and our costs were not very well defined.

From floor: In our experience along that line, we used and got treatment results in two ways. We collect all the condensate that we can and reclaim it for high pressure boiler feed. We did have a reduction in steam reboiler tube corrosion and a reduction in iron going back to the two high-pressure boilers. One little operating gadget, which some of you have probably run into, is attractive in some of our reboilers. This is to find the concentration of carbon dioxide at some level of the head and then vent that off. It has done a lot of good.

Brown: We had corrosion which we thought at one time might have been carbon dioxide, but was actually dissolved oxygen. We went to further deaeration on the feed water and eliminated a big part of what we had thought to be carbonic acid gas corrosion. The vent idea is a very good one, and we do use that also.

Heike: Ten years ago at the government plant at Cotton Valley, we ran into this too. As far as reboiler tubes were concerned, we placed much of the blame on the method of control which involved using exhaust steam in reboilers and flow-controlling the condensate from the reboilers as means of heat control. As such, this kept some of the tubes submerged in condensate all the time. We eventually switched that around to put the valve on the steam coming in, and installed a steam-trap on the outlet to keep the tubes as dry as possible. Of course, that takes care of the reboiler tubes but not the return lines. We did add one of the organic inhibitors to get the pH back up: I don't recall which one it was.

What is the experience of others in the protection of submerged sections of pipe coils against carbuncle or barnacle type water-side corrosion? Have cathodic means been employed economically on pipe cooling boxes?

Edwards: We had fair success for about two years in the use of cathodic protection in two overhead condenser boxes. But, due to a process change, we removed those two boxes and at that time decided that the better method was to treat the cooling water. We now combat all types of corrosion in submerged sections by using acid treatment of cooling water, combined with the use of chrome glucosate, controlling the pH to about 6.5. We have had very good success and very low cleaning costs.

From floor: We have had a lot of trouble with chlorides, besides corrosion, when we started the water policeman on the job to redistribute the water usage. We had an experience with some carbon steel coils carrying residuum which would last about eight years. When we started water policing, it gave us a little more water and more cooling for the residuum. But then we started running into coil corrosion.

We had to assume that the higher temperatures had caused a deposition of salts on the tubes so that we were getting a protective coating on them. We had not had this when we started using the cooler water. Now, the cooling water keeps the coil cool, so we are going to try some galvanized tubes in that particular section to see if it will help. I don't know yet whether it will.

What experience have other operators had in firing induced and forced draft, bent-tube boilers with sour gas as far as deposits in the air preheaters are concerned?

Wilson: The deposits we were getting in the air preheater were free sulfur. The only solution that we have come to is to discontinue using sour gas and to fire with sweet. (*Laughter.*)

Edwards: At Borger, we have a 100,000 lb./hr., Wickes Type A boiler which we fire with either gas or resid. It is equipped with induced and forced draft fans. The air preheater is designed for countercurrent flow. We did have trouble originally on the flue gas side of the preheater tubes. We got around that problem by simply bypassing a portion of the incoming air around the preheater in order to get the flue-gas temperature above the flue-gas dew point. Since that time, we have had no problem.

What treatment other than ammonia is being used to neutralize hydrogen chloride in straight-run gasoline streams when Admiralty condenser tubes are being used?

Brown: Two compounds we are using on Admiralty condenser tubes, when ammonia is being used to neutralize the hydrogen chloride, are "Kontol" — a Tretolite Co. product — and "Stanolind 601," made by Stanolind Oil & Gas Co. In both cases, they have been very good in preventing fouling, particularly on the straight-run gasoline condensers. On the crude exchangers, where we have lengthy runs, our equipment had been fouling in about 30 days. Now, we haven't pulled the bundles for the past six months. Both of these compounds have been very effective.

Eckhouse: I would also like to add the name of "Unicor" to that list, it being the Universal Oil Products Co. corrosion inhibitor. It is a film-forming type of inhibitor and it really is quite amazing that it will wet a condenser or an exchanger tube preferentially to ammonia, which is certainly a good wetting agent in its own right.

Rippee: Corrosion by hydrogen chloride on a vapor-to-crude heat exchanger often is quite rapid. One time, the Spang-Chalfant Co. prepared Admiralty with 0.5% more tin, and that increased the life of these tubes ten times over the regular Admiralty composition. That product has been available on the market for some time and it could be used in this application.

What is the best material and the best method for algae control in cooling towers?

Gearhart: I won't attempt to say what is the "best." I can only tell you what we do. Our suggestion in treatment for the control of algae is to use intermittent instead of continual treatment of the water—in other words, "shock treatment."

We use two different types of treatment, alternating them every two weeks. One is sodium pentachlorphenate, under the trade name "Santobrite." The other is a chlorinated compound called "Algar." The concentrations of that run about a gal. to 30,000 gal. of water.

We still have some small amounts of algae growing even after such treatment, but the most important point—I think—is shock treatment. Or, if algae do persist in growing, maybe change the type of treatment to something else. Algae seem to build up a resistance to any given type of treatment.

From floor: We use three different types of compounds in our cooling waters as a "slug" treatment, once a week. We have three cooling towers and we switch the compounds every other week.

Has anyone had experience with chemical treatment for preventing delignification in cooling tower packing and structures?

Parker: There is a "treatment" that

you gentlemen may be familiar with. That is the use of a ceramic cooling tower. It does not have any lignin in it.

What results have been experienced by hot-dipping redwood cooling tower lumber in aromatic gas oil before installation to prevent bacterial decay and delignification?

Edwards: I don't know that I understand what is involved here, but I think it may be the use of any of the pentachlorphenols in aromatic gas oil as solvent. I understand that Chapman Chemical Co. over in Memphis, Tenn., and the American Wood Preservatives Association have both used aromatic gas oils which can carry in solution at least 10% pentachlorphenol. This functions, I believe, both to prevent delignification and also bacterial decay.

From floor: Does the tower have to be down for the application?

Edwards: I believe that this use has been more for railroad ties, telephone poles, and piling, excluding salt-water pilings. It certainly could be used for redwood cooling tower lumber, and that is the reason I mentioned it.

From floor: We have just put in a new cooling tower and some new sections in an old tower, as recommended by the Fluor Corp. They say it isn't necessary to put in the pentachlorphenol as long as catalytic light cycle gas oil is used. We considered soaking this new tower section before we put it in. But, then we didn't want to take the time to do it. They say it will prolong the life of the tower.

Does any refiner in this group use sulfuric acid for pH control of his cooling tower water? Discuss briefly its use and control of the dissolved solids content.

Feasel: I don't know too much about this. We have been using sulfuric acid for pH control for a good long while. Our water normally is taken from wells adjacent to the Cimmaron River, which is primarily high in chloride content—something on the order of 3000 ppm. We add enough acid to reduce the alkalinity from 170 to about 100.

As far as controlling dissolved solids is concerned, we don't particularly watch that angle, except as a measure of cycles. We use Betz chemicals and we think they do an excellent job. Along with the acid control, in one instance we use chromate and in the other we use a phosphate—in separate cooling towers, of course.

Who Were the Experts?

E. A. Heike, Premier Oil Refining Co.

J. M. Brown, Pan-Am Southern Corp.

R. E. Feasel, Deep Rock Oil Corp.

J. A. Gearhart, American Liberty Oil Co.

R. S. Wilson, Lion Oil Co.

J. G. Eckhouse, Universal Oil Products Co.

O. D. Edwards, Phillips Petroleum Co., Perco Division.

D. E. Norris, Houdry Process Corp.

F. D. Parker, Blaw-Knox Co., Chemical Plants Division.

C. W. Rippee, Electric Process Co.

From floor: There has been just a little bit on that in the literature recently. Panhandle Eastern had a paper at an American Society of Mechanical Engineers meeting on an automatic sulfur burner. They do not have too good data yet on how it's working. Some Panhandle men were at a meeting of the Natural Gasoline Association of America a couple of weeks ago in Oklahoma City, and the only comment they would make then was that they had had trouble with the sulfur burner at the stack. I imagine they can probably get that solved. Otherwise, the natural gasoline people are interested in the automatic features of that particular installation. You might write to J. T. Russell of Panhandle Eastern for more information.

From floor: Back to sulfuric acid use on pH control: Several years ago—too many years, really—I calculated how much money we could save by using sulfuric acid. And the next time our water treating chemical representative came around I chided him no end that—here is a chief chemist for a refinery and he had not told me that I could save money by the use of sulfuric acid.

He said, "Why, Charlie, you and I are pretty good friends. If I told you about sulfuric acid, you'd use it, and then you'd get into trouble. Then I don't think we'd be friends any longer and I might lose some water treating business."

I said, "That's the wrong attitude. I'm going to use it. I'm going to get along fine."

Well, I did use it. And I got into trouble, like everybody else who uses sulfuric acid. I got too much acid into the cooling tower water. Then, we tried frantically to get some caustic in there in a hurry. Well, I didn't have a good set-up.

A few years ago, another friend of mine—chief chemist of a well-operated refinery—decided to use sulfuric acid. He's a very religious boy. That sulfuric acid—the control of it, really—nearly cost him his religion. But he, like a lot of other people, is actually using sulfuric acid for pH control and does a good job on his water treating.

The only real precaution is "what is a good system for maintaining the correct pH and not getting too much sulfuric acid in there in slugs."

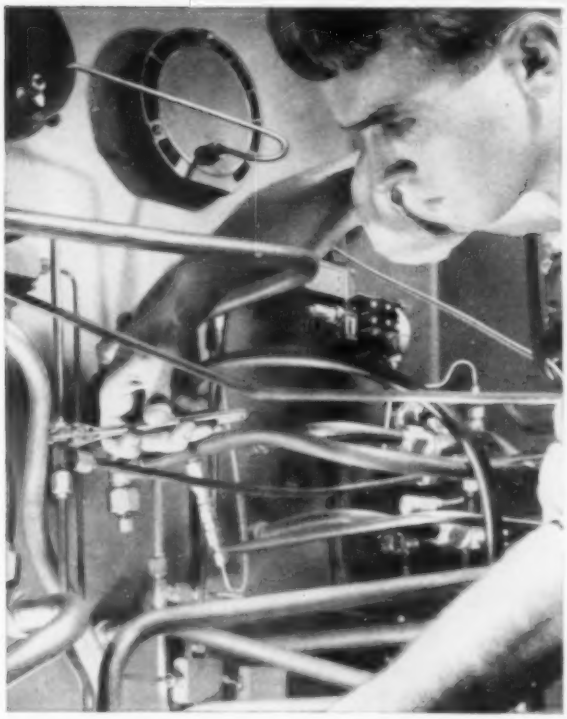
Feasel: That is the problem, all right: avoiding the possibility of getting too much acid into the water. We are using a dispenser manufactured by American Water Softening Co. I believe the amount of acid the unit can dispense is in the order of some 50 or 60 gal. and that is proportioned out over quite a lengthy period of time. Up until now, we've never had any difficulty with it.

What causes LPG copper strip corrosion and what is the most satisfactory method for preventing it?

Rippee: The copper strip test on LPG has been a particular problem ever since LPG began to be an important factor in the petroleum industry. The corrosion can well be illustrated by evaporating butane with a copper strip after the butane has been treated by different strengths of caustic soda. Most LPG after treatment with 10° Be. caustic soda solution will pass the copper strip test.

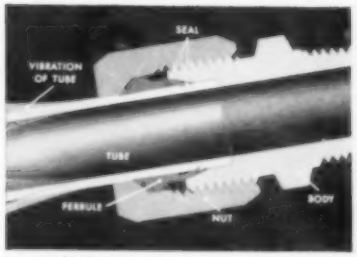
If the same butane had been treated with a 15 or 20° Be. caustic soda, an oil-soluble soap would have been formed. The copper strip will be darkened and the sample will fail to pass the test. Phillips Petroleum Co. is one of the large marketers of LPG: they refuse to purchase LPG failing to pass the copper strip. This method was the simplest and most economical way of getting it to pass the test.

If furnace oil is treated with strong caustic, the sodium soaps can never be removed through 30 ft. of clay filters. Such furnace oils fail to pass the soap test. As a general rule, heavy caustic treatments damage most petroleum oils, and especially, if the caustic should ever be heated in these operations.

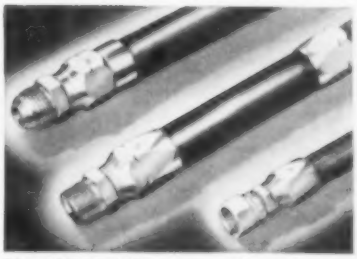


"Tube up and forget it" with leakproof Parker fittings

Triple-lok flare fittings are the easiest, fastest and safest way to tube up even in close quarters. They are absolutely leakproof even under the severest conditions of vibration, high pressures and temperatures. *Triple-lok* fittings meet J.I.C. and S.A.E. Standards plus specifications of the A.S.M.E. Code for Pressure Piping. Available for tubing outside diameters from ⅛ through 2 inches. More *Triple-lok* fittings are used on industrial machinery than any other fittings.



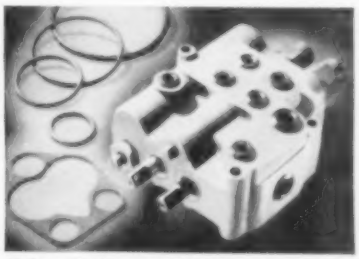
Ferulok flareless fittings, featuring the visible "bite", are especially for high-pressure, heavy-wall tubing. Cutaway shows why vibration won't break the seal.



New Hoze-lok fittings and hose assemblies (for medium and high-pressure hydraulic service) offer better performance, easier make-up, greater re-usability.

New Weld-lok fittings are machined from high-quality steel or stainless-steel bar stock and forgings. They are available for tubing ¼ through 2 inches, O.D.

New Intru-lok tube fittings can be quickly installed by anyone. Simply push tube in, then tighten nut. Designed for instrumentation lines of ¼ through ½ inch, O.D.



Other Parker products include new hydraulic control valves, check valves, accumulators and O-rings. Mail the coupon for the fitting catalogs you want.

TUBE AND HOSE
FITTINGS DIVISION
Section 411-S

The Parker Appliance Co.
17325 Euclid Avenue
Cleveland 12, Ohio

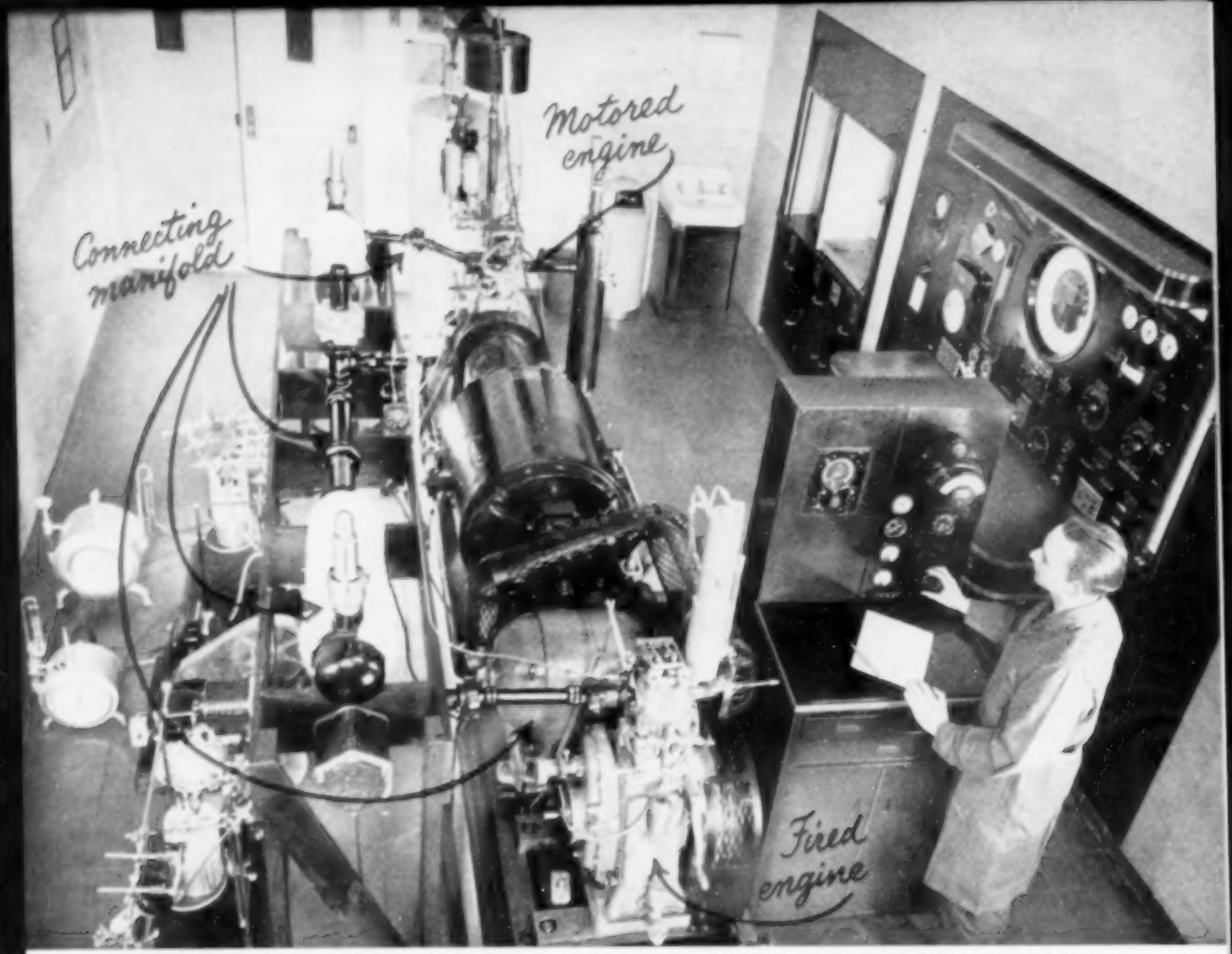
- ☐ Send Triple-lok & Ferulok Catalog No. 4300
- ☐ Hoze-lok Catalog No. 4400
- ☐ Weld-lok Catalog No. 4370
- ☐ Intru-lok Catalog No. 4320A1

Name _____ Title _____
Company _____
Address _____
City _____ State _____

Parker

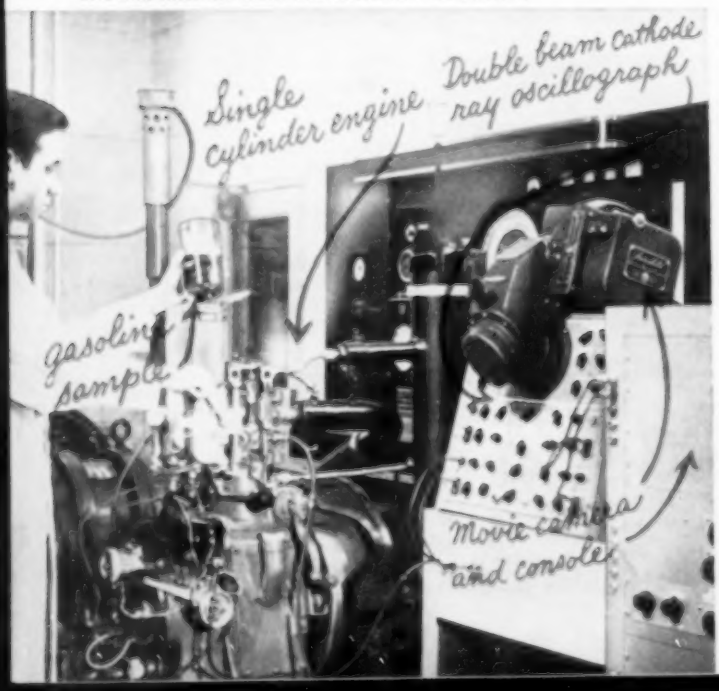
Hydraulic and fluid system components

(To obtain more data on advertised products see page 564)

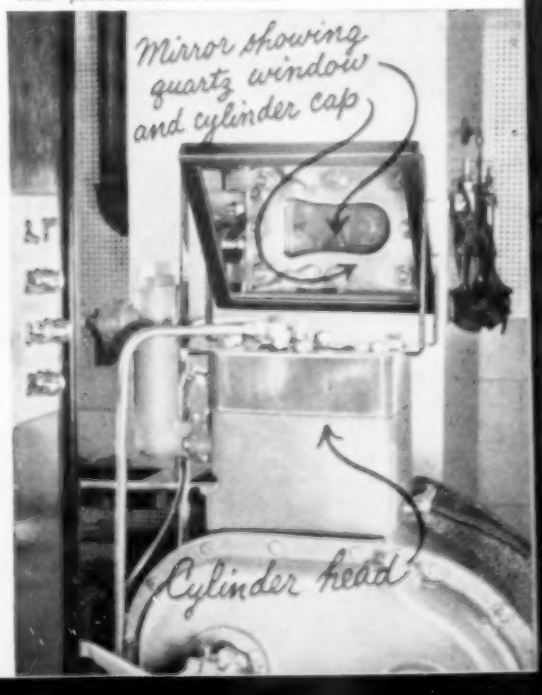


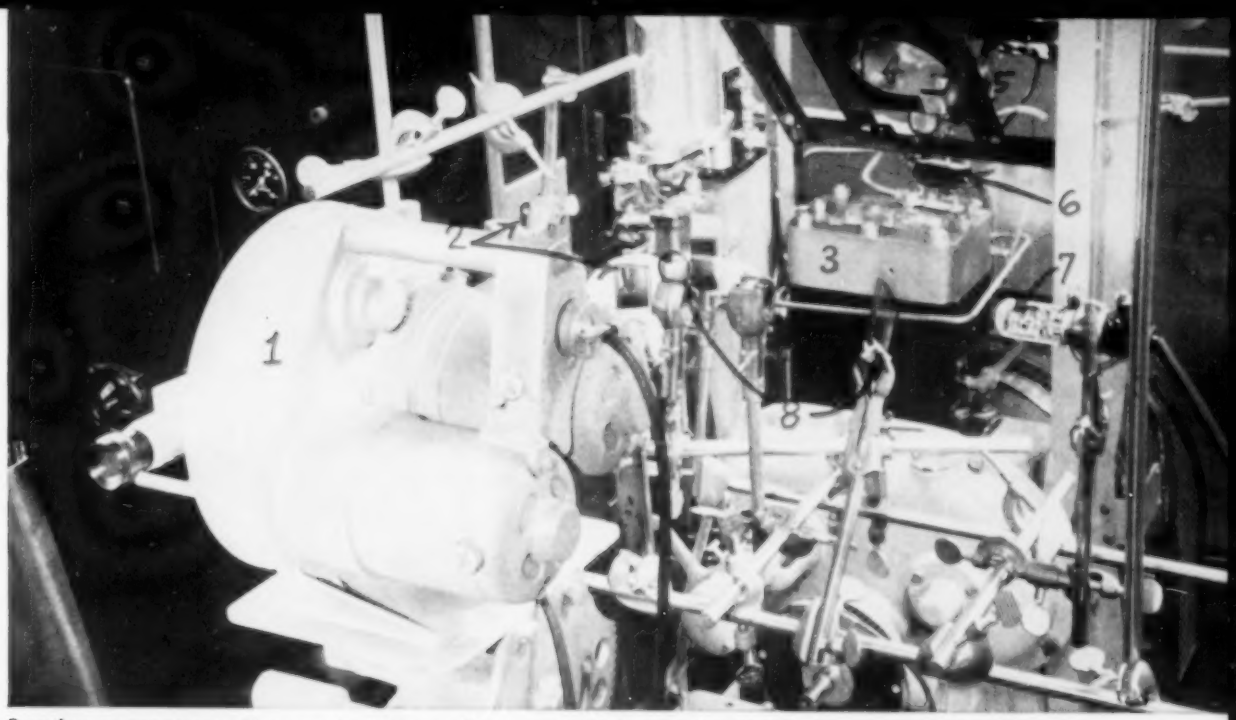
Tandem engine arrangement permits Ethyl Research to produce any desired amount of precombustion reaction by varying compression ratio in a motored engine. The effect of precombustion on knock can then be evaluated in the second engine.

Pressure-time records of modern high-speed engines require expensive and intricate instrumentation like that below.



Direct view of quartz head shows how camera "sees" precombustion reactions.





Complex arrangement of lenses and mirrors permits camera to photograph "cool" flame in engine cylinder utilizing variations in the refractive index of the hot gases. 1. Fastax high-speed movie camera. 2. Mirrors. 3. Cylinder head equipped with quartz window. 4. Mirror showing light reflected from piston top. 5. Synchronizing light. 6. Timing light. 7. Light source—zirconium arc. 8. Optical filters.

Ethyl Research takes a look at precombustion

The instant an air-fuel charge is pulled into the cylinder things begin to happen. The intake valve closes, compression starts—and even before the charge is ignited—important chemical changes take place in the fuel. Just what are these changes? How do they affect the operation of the engine?

Ethyl Research people have been pioneering in this unknown area for years. In their studies they have developed several new techniques, which are helping to fit together the answers.

Among these is a precombustion ("cool" flame) photographic setup using shadowgraph techniques. In this instrumentation a complicated series of lenses and mirrors is arranged so that a high-speed camera capable of 7200 frames a second can photograph "cool" flames in a special test engine. At the same time it picks up flywheel timing marks. A second camera—synchronized with the first—photographs instantaneous pressure traces from the oscilloscope. In this way "cool" flame and pressure records can be precisely correlated.

Another of these special Ethyl instruments is the tandem engine. Here precombustion reactions of different degrees can be made to occur by varying the compression ratio of a motored engine. The reaction products are then rated in a fired engine to find the direct influence of the early reactions on knock.

By analyzing various test results, Ethyl Research has developed a better understanding of precombustion reactions, and thus has added to the general knowledge of the combustion process.

These precombustion studies are an important part of "Ethyl's" basic research program.

ETHYL CORPORATION
Research Laboratories

1600 West Eight Mile Road, Ferndale 20, Michigan
2600 Cajon Road, San Bernardino, California

11 ALL-IMPORTANT FACTORS WHICH DETERMINE THE VALUE AND EFFICIENCY OF PROCESSING FURNACES

✔**UNIFORM HEAT DISTRIBUTION**
MAXIMUM FUEL EFFICIENCY
PLENUM CHAMBERS FOR HAZARDOUS AREAS
SIMPLICITY OF DESIGN AND CONSTRUCTION
EXCESS DRAFT FOR HIGH OVERLOAD
EXPLOSION RESISTANT
MINIMUM GROUND SPACE
SHORT LENGTH OF LIQUID TRAVEL
ZERO AIR LEAKAGE
LOW PRESSURE DROP
LOW MAINTENANCE

✔**UNIFORM HEAT DISTRIBUTION** the most desirable heater characteristic is created in an Iso-Flow furnace by:

1. Individual burners are so spaced in relationship to the heating elements that they create a symmetrical flame pattern with relation to the tubes;

2. The metal cone at the top of the combustion chamber re-radiates to the tubes, also diverts combustion gases progressively closer to the tubes to give a uniform heat intensity at the upper portion of the combustion chamber;

3. The combustion gases, at the top of the heater, are diverted towards the walls where they recirculate from the top of the heater downward, behind and between the tubes, increasing the heat input to the rear of the heating elements by convection;

4. The recirculated gases reduce the heat intensity at the bottom of the furnace so that the heat input is the same, top and bottom.

These factors provide the completely uniform heat distribution required in heaters for the most efficient process operation.

In every case where these 11 all-important design characteristics were employed to compare one type of furnace design with another, PETROCHEM-ISOFLOW FURNACES *were proved most efficient by any comparison.*

Prove PETROCHEM-ISOFLOW FURNACES Most Efficient by Any Comparison

More than 1200 PETROCHEM-ISOFLOW FURNACES *are in operation throughout the world in the petroleum, chemical and allied industries . . . for all processes and for any duty, pressure, temperature and efficiency . . . and all Petrochem-Isoflow Furnaces are pre-eminently satisfactory.*

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE ... CAPACITY ... DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 East 42nd St., New York 17, N. Y.

Representatives: Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. B. Foster, Pittsburgh • Fanillo-Levally, Chicago • Lester Oberholtz, Los Angeles • Gordon B. Hardin, Louisville • Turbex, Philadelphia (Norberth, Pa.)
Foreign Licensees: England – BIRWELCO, LTD., Birmingham 6 • France – HEURTEY & CIE, Paris • Germany – DR. C. OTTO & COMP., Bochum

Petroleum Processing

APRIL 1955

Petrochemical Section

IN THIS SECTION

Detergents Your Dish?

The outlook for synthetics is for a growing share in a growing market, reaching 75% by 1962—p. 527

Cut Maintenance Costs

How Ethyl at Baton Rouge is making a $4,000,000 maintenance improvement program pay off—p. 530

Send Supplies by 'Train'

Here's an in-plant maintenance $$ saver—p. 530

In the Departments

How to use inhibitors to reduce condenser corrosion and fouling, plus other shop ideas—(Plant Practices) p. 539

Better tank cleaning with a new "3-D" rotating nozzle —New "electronic" supervisor for plant control— Foam type insulation you can spray on—plus dozens of other new equipment and materials ideas— (What's New) p. 565

OTHER DEPARTMENTS

Personnels 548
Patents 549
Suppliers 553
Books 557
Meetings 561
Information Offered 562
Advertisers' Index 564
Editorials 566

THE NEW GILBARCO ELECTRONIC TANK GAUGE

MEASURES THIS ACCURATELY...

The Gilbarco Electronic Tank Gauge gives you accuracy to within *1 16th of an inch plus or minus* — the thickness of a quarter! This gauge actually measures electronically — not with a float. It is the only gauge today that offers you all these time- and money-saving advantages:

★ At least 100% more accurate than hand gauging, or any other automatic gauge

★ Capable of remote transmission with equal accuracy

★ Equipped with positive operational checks for assurance of accurate performance

★ Can be supplied with *automatic switches* for selecting proper resistance in averaging temperature instruments.

***Automation* in Liquid Level Gauging is brought to Refineries, Pipe Lines and Terminals with the Gilbarco Electronic Gauge.**

Write now for illustrated brochure with full details.

Gilbert & Barker Mfg. Co.
West Springfield, Mass.

Gentlemen:

Please send me brochure on the Gilbarco Electronic Tank Gauge.

NAME _____

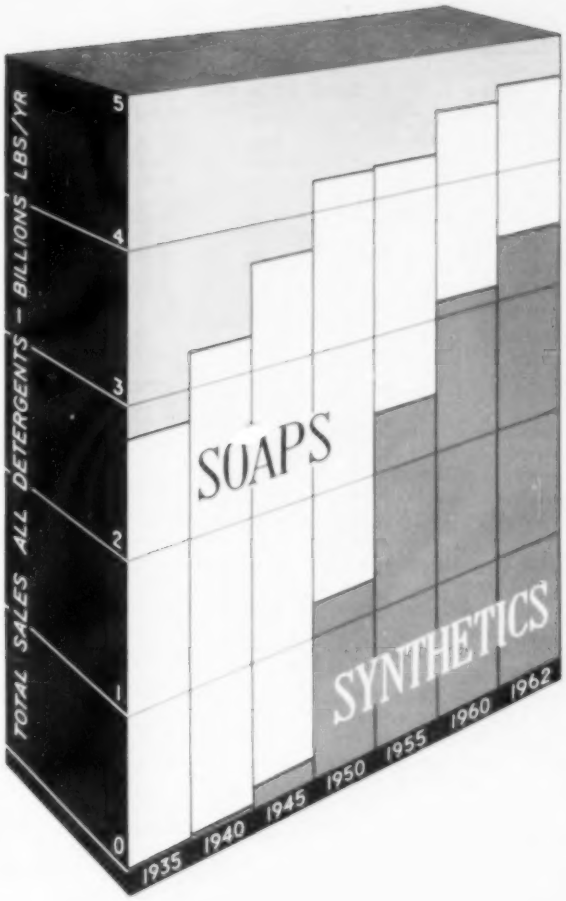
COMPANY _____

ADDRESS _____

CITY _____ STATE _____

Gilbarco

Gilbert & Barker Mfg. Co.,
West Springfield, Mass.,
Toronto, Canada



Synthetic Detergents by 1962

Bigger Share of a Bigger Market

SYNTHETIC detergents will have captured approximately 75% of the total detergents market on an "as sold basis" by 1962, with conventional soaps dropping to 25%. This represents a change from the 1954 estimated ratio of 55% for synthetics and 45% for soaps. The change is depicted graphically in the chart above and is given in more complete detail in Table 1.

To producers of organic ingredients, this projection to 1962 represents a market for 1,053,600,000 lb. of 100% active organic synthetic detergents. Total projected sales for finished synthetic detergents is 4,682,000,000 lb./yr. in 1962, and the average synthetic contains less than 30% active ingredient.

This summary of a forecast of market trends made by J. Ralph Macon of Atlantic Refining Co.* is based upon four assumptions:

1—Per capita consumption will remain relatively constant.

2—Synthetic detergents will ultimately take over more of the market for packaged soaps, scouring powders, liquid cleaners, and other cleaning agents.

3—Synthetics will continue to move slowly into the toilet bar field.

4—Industrial applications—although significant—will continue to expand in the same approximate relationship to household products.

The estimates, Mr. Macon said, are also predicated upon the fact that marketing conditions will remain relatively constant, and that the household formulations of eight years hence will in general contain about the same amounts of organic synthetic ingredients as do the current products.

One possible adverse effect on this sales volume trend may occur if the automatic home laundries and dishwashers should prove that formulations with lower percentages of the organic ingredients can maintain the same level of detergency and by a standard discernible by the purchasing housewife.

* Mr. Macon, market and product development manager, chemical products sales, Atlantic Refining Co., presented this paper, "Market Trends of Organic Synthetic Detergents," at the annual meeting of the Association of American Soap & Glycerine Producers, Inc., in New York City, January 28.

Table 1—U. S. Total Soap and Synthetic Sales

(As Sold Basis in Millions of Pounds, 1935-1954 and Projected 1962)

Year	Total	Soap Sales	% of Total	Synthetic Sales	% of Total
1935	2,778	2,776	99.93	2	.07
1936	3,046	3,041	99.84	5	.16
1937	2,958	2,948	99.66	10	.34
1938	3,141	3,126	99.52	15	.48
1939	3,324	3,306	99.46	18	.54
1940	3,236	3,206	99.07	30	.93
1941	3,842	3,802	98.96	40	1.04
1942	3,639	3,589	98.63	50	1.37
1943	3,540	3,465	97.88	75	2.12
1944	4,215	4,060	97.03	125	2.97
1945	3,724	3,574	95.96	150	4.04
1946	3,203	2,928	91.40	275	8.60
1947	3,952	3,552	89.90	400	10.10
1948	3,692	3,142	85.10	550	14.90
1949	3,777	2,962	78.40	815	21.60
1950	4,204	2,955	70.30	1,249	29.70
1951	3,878	2,444	63.10	1,434	36.90
1952	3,959	2,210	55.80	1,749	44.20
1953	4,082	1,948	47.50	2,134	52.50
1954*	4,147	1,865	45.00	2,281	55.00
1955	4,214	1,770	42.00	2,444	58.00
1956	4,283	1,606	37.50	2,677	62.50
1957	4,349	1,522	35.00	2,827	65.00
1958	4,416	1,435	32.50	2,981	67.50
1959	4,482	1,345	30.00	3,137	70.00
1960	4,549	1,296	28.50	3,253	71.50
1961	4,616	1,200	26.00	3,416	74.00
1962	4,682	1,170	25.00	3,512	75.00

Data: Association of American Soap & Glycerine Producers, Inc. (Expanded to represent total industry)

* Estimated based on 9 months sales.

Table 2—U. S. Production of Alkyl Aryl Sulfonate Detergents vs. Total Synthetic Detergents

(In millions of lbs, 100% active bases, 1939-1954)

Year	Total Synthetic[1]	Alkyl Aryl Sulfonate[2]	Percent of Total
1939	7.2	3.5	48.6
1940	12.0	6.0	50.0
1941	16.0	8.0	50.0
1942	20.0	10.0	50.0
1943	30.0	24.7	82.3
1944	94.3	31.4	33.2
1945	106.0	41.7	39.3
1946	183.6	45.9	25.0
1947	227.1	55.4	24.4
1948	253.0	101.4	40.0
1949	265.6	147.1	55.3
1950	571.3	251.8	44.0
1951	569.3	317.6	55.7
1952	610.5	307.2	50.3
1953	716.2	364.2	50.8
1954	750.0[3]	382.0	51.0

Data: U. S. Tariff Commission.

(1) Total excludes petroleum aromatic sulfonated compounds, salts of fatty acids, sulfated and sulfonated acids (fish oil and oleic acid), isopropyl oleate, animal fats and oils, and fish and marine animal oils.

(2) Alkyl aryl detergents include only alkyl benzenoid compounds (sulfated and sulfonated): dodecyl benzene sulfonic acid types.

(3) Estimated in 1954.

From a beachhead of 2,000,000 lb., 0.07% of total detergent sales, which the synthetics established in 1935, they began an upturn to a full-scale invasion in 1947, with 400,000,000 lb., 10.1% of total sales. Then, in 1953 the synthetic sales overturned the balance, hitting 2,134,000,000 lb., or 52.5% of sales.

What has this meant to petrochemical producers? An analysis of U. S. Tariff Commission production figures for 1953 (Table 2) shows that out of a production of 716,200,000 lb. of synthetic detergents—on a 100% active basis—a total of 364,200,000 lb. of alkyl aryl sulfonates were produced, or about 51%. It is estimated that in 1954 total synthetics produced were 750,000,000 lb., and alkyl aryl sulfonates were 382,000,000 lb., again 51% of the total.

This relationship for the alkyl aryl sulfonates has held relatively constant for the past several years. It should be remembered that the active organic detergent constitutes approximately 30% of the grand total when these figures are compared with the "as sold" figures in Table 1.

The prominence of the alkyl aryl sulfonates has been attributed to its high detergency properties and sudsing characteristics, as well as susceptibility to large-scale production at low cost, combined with price stability. This is demonstrated by the data in Table 2. In addition to increased sales of synthetics, the sharp rise in total production indicated during 1949-50 is also attributed to more accurate classification of groups of compounds by the Tariff Commission and a greater number of reporting companies.

The remaining 49% of organic syn-

Table 3—U. S. Total Synthetic Detergents Production by Types

(100% active basis, millions lbs, 1946-1953)

Year	Total	Alkyl aryl	Non-ionics	Sulfated Acids, amides, esters,*	Sulfated alcohols, etc.
1946	183.6	45.9	20.7	33.1	83.9
1947	227.1	55.4	24.9	13.4	113.4
1948	253.0	101.4	44.2	20.7	86.7
1949	265.6	147.1	45.2	12.3	61.0
1950	571.3	251.8	79.1	17.1	223.3
1951	569.3	317.6	75.5	10.3	165.9
1952	610.5	307.2	104.5	20.7	178.1
1953	716.2	364.2	135.0**	23.0	194.0

Data: U. S. Tariff Commission and industry estimates.

* Excludes oils, fats, and waxes.

**Excludes certain lauric, oleic, and stearic acid esters.

Table 4—U. S. Total Solid and Liquid Synthetic Detergent Sales

(in millions of lbs, on as sold basis)

Year	Total	Solid	Liquid	Liquid as % of Total
1948	402	401	7.1	negligible
1949	712	702	10.3	1.45
1950	1093	1071	22.6	2.06
1951	1255	1217	38.2	3.04
1952	1530	1481	49.6	3.24
1953	1867	1782	84.6	4.52
1954*	2077	1962	115.0	5.60

Data: Assn. of Amer. Soap & Glycerine Producers, Inc. (Sales by members).

* Estimated, based on nine months total sales.

thetic detergent production is composed of non-ionics, sulfated alcohols, sulfated and sulfonated acids, amides, and esters, cationics, and miscellaneous groups, as shown in Table 3, for the years 1946 to 1953. Here again, the strong position of the alkyl aryl is well demonstrated.

Production of non-ionics has risen from 21,000,000 to 135,000,000 lb. between 1946 and 1953. During the same period, the sulfated acids, amides and esters have remained stable. Sulfated alcohols are not reported separately, and are included here with cationics in the miscellaneous group. However, it is believed that sulfated alcohols constitute the most significant portion of this group during the period reported on.

For example, in 1953, from Tariff Commission data and other industry sources, it is estimated that of the detergents other than alkyl aryl sulfonates, the non-ionics represented 18.8% and the sulfated alcohol production was almost as high, at 17.5% of the overall totals.

Liquid detergents are another facet in the changing picture of sales. Synthetics sales are generally divided into two main categories: solids and liquids. Solids have thus far represented the major portion of total sales (see Table 4). Liquid sales, however, have been increasing rapidly both on an absolute basis and as a percentage of total detergent sales. Table 4 shows that in 1948, liquid sales were negligible. Yet, by 1954, they had increased to 115,000,000 lb. and made up 5.6% of total sales volume, as estimated on the basis of nine months.

Formulation changes can affect volume requirements for the active ingredients in synthetic detergents—as was mentioned earlier—as can changes in demands for the finished products. Such a possibility exists today due to the increasing use of automatic laundry and dishwashing appliances.

Table 5—U. S. Production of Washing Appliances

Year	Motor-driven Dishwashers	Automatic & Semi-autom. clothes washers	Spinner-Wringer Type Clothes Washers
1946	not available	356,000	1,691,000
1947	120,000	962,000	2,695,000
1948	225,000	950,000	3,246,000
1949	160,000	928,000	2,137,000
1950	230,000	1,646,000	2,626,000
1951	260,000	1,589,000	1,795,000
1952	175,000	1,684,000	1,582,000
1953	180,000	1,975,000	1,525,000
Totals	1,350,000	10,090,000	17,297,000

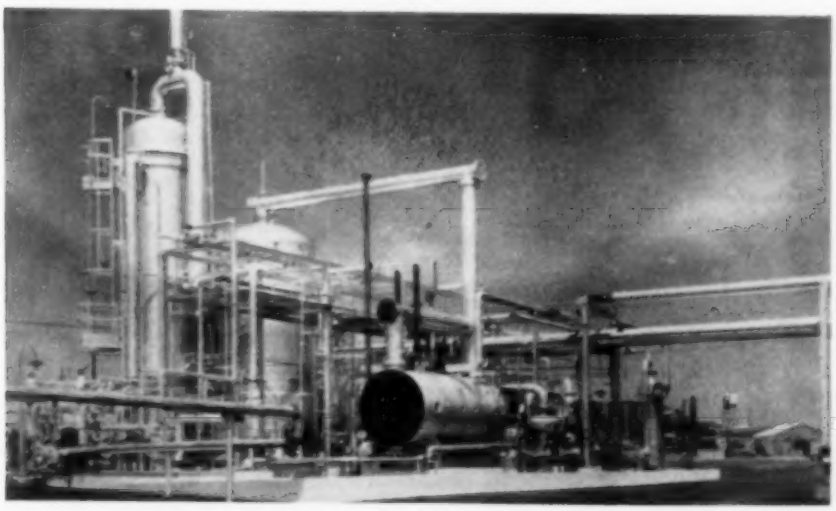
Source: *Electrical Merchandising*, Jan., 1954 (McGraw-Hill).

In Table 5, it is shown that from 1947 through 1953, sales of motor-driven dishwashers have totalled 1,350,000, or an average of 193,000 per year. Sales of automatic and semi-automatic laundry machines totalled 10,090,000 from 1946 to 1953, and now represent more than 20% of the washing machines in use. Downward trends in the sales of wringer-spinner type machines indicate that the automatic types will continue to rise.

The household detergent market is of course the largest and most important, representing 85 to 90% of the total. However, there is today a long and impressive list of industrial uses in a great variety of applications for synthetic detergents or surface active agents which constitute the remaining 10 to 15%. Some of the more important industrial uses for alkyl aryl sulfonates are shown in this list:

Scouring powders.
Textile applications, such as wool scouring, dye leveling, kier boiling, and other auxiliaries.
Alkali type dairy cleaners.
Metal cleaning compounds.
Janitor supply products.
Automobile washing compounds.
Gypsum board frothing agents.
Portland cement and cement block air entraining agents.
Initial emulsifiers in emulsion polymerization processes.
Fertilizer curing.
Herbicides and insecticides.
Fruit and vegetable washing.
Leather treating compounds.
Paint stabilizers and pigment dispersants.
Pharmaceutical processing.
Firefighting compounds.

NEWS in VIEWS



SULFUR RECOVERY at Aruba. This 40 ton per day plant, along with associated equipment for gas purification (for removing the hydrogen sulfide from sour fuel gas) has been placed on stream at the Netherlands West Indies refinery of Lago Oil & Transport Co., Ltd., a subsidiary of Jersey Standard. Designed and engineered by the Girdler Corp., it was constructed by M. W. Kellogg Co. Because of a short supply of fresh water at the plant site, facilities have been designed to use sea water as a coolant.

How Ethyl Cut Maintenance Costs

BY PEGGING its $4,000,000 program to slash the high cost of maintenance at the Baton Rouge, La., plant on points illustrated on these pages, the Ethyl Corp. has been able to reduce maintenance manpower requirements by 10 to 12%. This program included:

1—Combining the previously scattered and inadequate shop and stores facilities into one modern, centralized location for more efficient control of both maintenance and construction operations.

2—Streamlining the delivery of supplies, materials, and tools from the new centralized location to maintenance personnel in the field.

3—Setting up daily scheduling and instituting a continuous program of checking on job methods.

The new building, compared to the former poorly lighted and crowded building scattered over the plant area, is designed for efficient work, smooth materials handling, and economical stores inventory control.

Important as facilities are, the efficient utilization of maintenance labor on the job has produced equal, if not greater maintenance savings than the centralized shop and stores building.

The total capital expenditure for the project was estimated at approximately four million dollars. Justification for this large expenditure before the Board of Directors was the estimate—based on the modernization study—that Ethyl could realize manpower savings of about 10%.

The Problem Ethyl Faced . . .

Ethyl Corporation's Baton Rouge plant started production in 1937, and today is one of the ten largest chemical plants in the United States.

Until March, 1950, all maintenance work was scheduled by maintenance and operating personnel weekly.

Shops were scattered throughout the plant in 17 buildings. Many of these buildings had been built in the early stages of plant operation, and their only supplement had been temporary construction buildings abandoned following plant construction work.

The old shops were crowded, poorly lighted, and drafty. There was too little provision for storage of materials and equipment. Control of operations in these widely separated facilities was difficult and inefficient.

Warehouse space had been acquired in much the same manner as had the shops, and consisted of 12 separate buildings and 8 outside storage areas scattered throughout the plant. Here again the wide separation of facilities caused a loss of efficiency from supervisory, materials handling, and work performance standpoints.

For 24-hour operation of a plant this large, the weekly maintenance scheduling and scattered shop and stores facilities soon became too inadequate and inaccurate for efficient plant operation.

. . . and What They Did

As early as 1946 Ethyl management set the framework for the preventive maintenance and stores organizations. In 1948 they began to move toward the modernization and centralization of maintenance shops and stores facilities.

The first step in centralization was for top management to approve a modernization and consolidation study. An outstanding consulting firm with considerable experience in the field of stores and shops modernization was engaged.

After extensive study, a project was formulated recommending placing the maintenance shops and stores facilities in one location in the plant. Also recommended was a complete modernization of these facilities with improved mobile and shop equipment, and adequate concrete or hard surface service and main access roads throughout the plant. More efficient scheduling of maintenance operations was needed too.

The Ethyl Board of Directors approved the entire plan in 1949, and construction began soon thereafter.

It is interesting to note that during the move of machinery and equipment from the old scattered field facilities to the new building in March of 1951, there was no interference with satisfactory operation of all plant production units.

Maintenance Organization

Ethyl's revamped maintenance organization is essentially allied with certain staff groups, such as the preventive maintenance group, etc., attached as service groups.

Directly under the assistant plant manager is the maintenance and construction section composed of four groups. Each of the four groups is headed by a superintendent. The groups are power and utility, construction, maintenance, and stores.

The plant is divided into three maintenance areas, each supervised by a principal area foreman with 18 to 20 first line foremen working under him in subareas.

Ethyl is convinced that the area foreman system has decided advantages over the overall craft foreman system by confining the foreman's supervisory activities to a small area to provide closer job supervision.

Area foremen handle all crafts with two exceptions. They do supervise boilermakers, machinists, welders, carpenters, iron workers, and all other normal craftsmen; but they do not supervise the instrument men and the electricians who have their own craft foremen in the field.

For operations in the central shop where more skilled work is done, there is a craft foreman for each craft.

There are 1200 men in the maintenance and construction organization, but not all of them are mechanics and helpers. The construction force is moved from a project onto maintenance or vice versa, depending upon the immediate requirements.

Crews assigned to the areas report to their particular area for each working day. These crews include all of the crafts and are assigned on the basis of need and experience.

Area crews are flexible, men being concentrated where they are needed. While it is attempted to keep work fairly stable in a given area, in cases of turnarounds for ethyl chloride units—similar to some refinery units—as many men are used as possible, still keeping the rest of the plant running. Shop crews can be sent to the field, or field crews to the shops, depending upon the immediate need.

Field crews consist of about 70% mechanics and 30% helpers at the

They centralized all shops and stores

They streamlined materials' deliveries

They began daily scheduling

CENTRALIZED SHOPS AND STORES (above), indicated by the building in color, are on the northeast corner of Ethyl's sprawling Baton Rouge plant. Previously, all such facilities were scattered throughout the manufacturing areas

FASTER DELIVERY of materials from stores to field (center). Motorized "train" loads of supplies leave central stores building, and are delivered to sheltered receiving stations in the plant

DAILY SCHEDULES and continuous follow-up (right). As jobs are finished, or not finished, this information is filled in on the daily scheduling form. Notes are added to explain reasons for incomplete jobs

MAINTENANCE DAILY WORK SCHEDULE

Priority	Job	Estimate	Job Work No.	Est. Man Hours
1.	Change A-17-A reduction gear.		7-10	
2.	Change turn-seal on B-3-A.		3-46	
3.	Check C-1-A Thermowell.		3-6	
4.	Change "2" wash house filter bags.		3-3	
5.	Change A-10 still condenser.		3-4	
6.	Clean grease from rear of A-6-A angle valve.		3-69	
7.	Replace #4 jet on C-1-A-6.		7-45	
8.	Install stainless steel baffles in A-17, 2 and 1A-6.			
9.	Change B-10-A charging head plugcocks.		3-1	
10.	Clean A-8 and 10-A vapor line ins.		3-7	
11.	Repair B-1-A charging head roll top.			
12.	Free up C-3-A discharge plugcock.			
13.	Change "2" disc. tail gas flash arrestor.		3-72	
14.	Align coupling on A-3-A motor.			
15.	Clean lead from rear of 1-1/2-A slide valves.		7-68	
			TOTAL	

Jobs Not Worked — No. — Reason

Lost Time — Job — Hours

Status Symbols

N.W.=Not Worked Today

N.C.=Worked Today, Not Complete

C.=Complete Today

MANPOWER

14	21	22	24	25	26	27	28	29	30	31	33	34	36	37	38	39	40	41	TOTAL
										4		3		4					
										4		3		4					

THE OLD—Machine shops had out-dated tools, inadequate handling facilities, crowded work space, and poor lighting

THE NEW—Up-to-date tools, plenty of space and good illumination, and overhead and jib cranes for better handling

present time. There are three grades of helpers and three of mechanics. Third-class is the lowest grade, consisting of new men in the helper forces, or the least experienced in the mechanics forces. All are required to spend a certain time in the field on work and be qualified before eventually progressing to first-class ratings.

Scheduling

The changeover from weekly to daily scheduling has been very satisfactory, and is credited with an appreciable portion of the 10 to 12% decrease in manpower requirements.

Daily scheduling is controlled and operated by the maintenance department, with the understanding that their success depends to a large degree upon the active participation of operating personnel.

In operation, a designated operating supervisor in each area sets high priority on maintenance jobs to be performed the following day. This is done prior to 1 PM daily, Monday through Friday.

At 1 PM, the designated operating superintendents meet with the scheduling engineers and the maintenance principal area foremen to plan and prepare the detailed daily work schedule for the next day.

Each job is listed in the order to be done. On the right-hand side of the schedule is a space for estimated hours, which is used sometimes. But the next column has space for recording the "job method." Since the job method anticipates the time required for the job, the estimated hours column is not used in this case.

Job methods are the result of detailed time studies made by Ethyl's industrial engineering section, and will be discussed in greater detail later in this article.

Regardless of size, all jobs are planned and estimated. The main exceptions are emergency jobs arising during the day which must be completed that same day.

Over-scheduling about 10% of the jobs—more jobs than men to do them—is a regular part of the daily scheduling conference. This allows work in case one of the higher priority jobs is cancelled or postponed. If the over-scheduled jobs are not completed that day, they are rescheduled the following day, or at some appropriate later date.

Unfinished jobs from the previous day, or postponed from another day, are also included in the daily schedule.

A completed schedule—usually by 2 PM—is given to the individual maintenance foremen for review. From this the foremen decide what stores materials they will need, and list these requirements on prepared forms.

The scheduling engineer then places orders for this material from stores. The majority of the stores orders will be filled on the three to eleven shift, and delivered prior to 7 AM the next

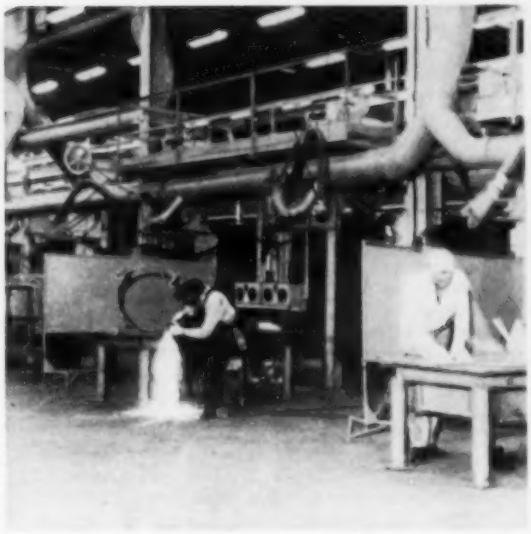
ETHYL'S "GOOD MAINTENANCE" CREED

The efficiency of any plant maintenance organization can be judged by the amount of process operation time free from accidents, downtime lost product, and emergency downtime, and by the economy of the maintenance operations.

Efficient labor utilization is the foremost single factor which can contribute to a smoothly running economical maintenance and construction section. Approximately one-half to two-thirds of the maintenance dollar is spent for labor.

Efficient labor scheduling and job planning are "musts" for efficient maintenance labor utilization and the maximum return on the maintenance dollar.

THE OLD—Original welding and boilermaker shop was only partially roofed and "well ventilated" in the winter



THE NEW—A modern welding area in central building with good lighting is designed for efficient and safe working

day, when it is needed.

A side benefit obtained from the planning and scheduling engineers section is the training of young engineers. The group usually has a nucleous of older engineers in the group. One engineer is assigned to each operating and maintenance area.

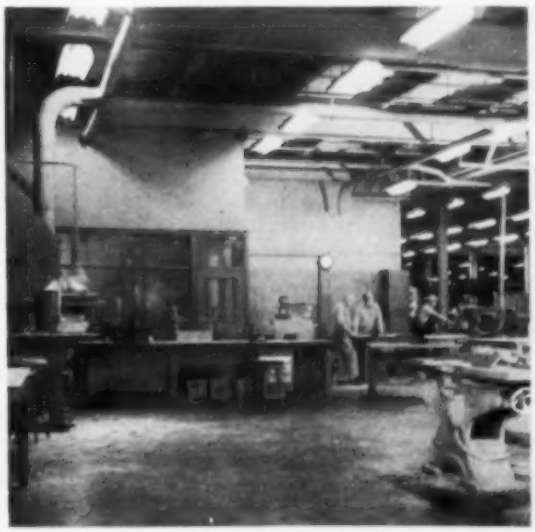
The duties of the scheduling engineer are clerical in making out the schedules. Actual know-how for planning is supplied by the principle area foremen who are aware—through their records and daily contact with the men in each of the subareas—of the work status and job assignments in their areas.

The previous day's schedule is turned in to the scheduling engineer by each maintenance foreman. On this schedule the status of all jobs is marked, and comments are made concerning the uncompleted or postponed jobs.

These completed schedules are reviewed daily by both maintenance and operating superintendents in order to keep all interested parties abreast of the status of various jobs.

Approximately 350 jobs are sched-

THE OLD—Carpenters used to face the same problems as the other crafts. Note the hard-to-reach, overhead lumber storage and cramped quarters generally



THE NEW—Now carpenters have wide open spaces to work in. Ventilated booth at left is for cutting insulation and helps keep dust down

uled as described above during a work week (Monday through Friday on the day and evening shifts) with an overall scheduling efficiency of 87% for the daily system.

Preventive Maintenance

The general requirements for a preventive maintenance program are decreased maintenance costs and increased equipment service factors.

Preventive maintenance responsibility is placed on every member of maintenance supervision, as success depends upon teamwork with information and improvement ideas exchanged between all interested personnel.

With the goal of decreasing maintenance costs by decreasing labor and material requirements and minimizing equipment downtime with scheduled instead of emergency repairs, it is necessary to have equipment performance standards and proper overall frequencies incorporated in the preventive maintenance schedule.

A top priority is given to preventive maintenance programs. Ethyl very seldom pulls men off of preventive maintenance to do normal maintenance work. They do not find it necessary. Ethyl also realizes that it pays dividends not to interfere with preventive maintenance which would mean earlier breakdowns of the unmaintained equipment.

Scheduling for preventive maintenance is on the regular daily schedule, with an item being entered on the schedule when records show that it is time for the regular check.

Field Deliveries

Stores centralization does not mean that the stores are in the center of the plant. Actually the centralized shop-stores building is located in a far cor-

Use Past Records to Measure Results

ONE of the first problems encountered by management in budgeting maintenance labor is the lack of a "yardstick" for the overall evaluation of maintenance performance.

Ethyl investigated the use of general maintenance criteria based on such rough factors as dollars of maintenance per million dollars of investment, and maintenance cost based on some unit of production. While these methods have some merit for general budget planning, they are either based on investment for some other base year—difficult to extrapolate accurately to the current year—or are not applicable to individual process units. As a result, Ethyl decided not to use either method of approximation.

At the time the source of a maintenance yardstick was being searched for, the plant had been in operation for five years. Maintenance requirements for the process units had reached a fairly constant level, thus establishing a manpower requirement based on a specific post-war year.

From the maintenance base-year selected, Ethyl developed a plan for the general role of maintenance labor which could be extended from a practical viewpoint to each of the operating units.

In the case of new units, some of the engineers would try to figure a maintenance standard by comparing the new unit to a similar plant or process, and perhaps add a 15% cushion. This is not very accurate, but serves as a starting point.

Base-year standards for maintenance are not the ultimate, but experience has indicated that the method is practical and meets Ethyl's requirements fairly well.

Once established, the base-year maintenance standards become basic figures used to determine monthly and annual maintenance manpower and labor dollar budgets. Adjustments are made when equipment is installed or removed, and when improved maintenance procedures are instituted.

These budget figures from year to year not only have reflected the improvement of Ethyl's maintenance procedures—based on reductions in maintenance costs—but have provided Ethyl's management with a basis of information necessary for control.

Job Method Studies

The industrial engineering section at Ethyl's Baton Rouge plant helps develop the basis for job evaluations and the writing of improved job methods. They work directly—on the same line—for the assistant plant manager and the plant manager. Several subgroups in the industrial engineering section cover functions of cost control analysis, procedures, evaluation, and time studies.

Graduate technical men are used in the industrial engineering section to provide good balance for the section, and to provide training for new engineers—to make them acquainted with the plant and become dollar conscious. Ethyl's budget allows for 13 men in this section.

Time Studies

Time studies have been used for a number of years by the industrial engineering section to aid in the establishment of operating labor requirements.

Requests for time studies come from the operations department, desiring operations time studies on existing, revised, or new units; from the industrial engineers' own thinking and observations; and by request from Ethyl's unions.

Several years ago the time-study technique was applied to develop improved job methods for preventive and repetitive maintenance.

Possible savings on repetitive and preventive maintenance jobs were indicated by the study. Some savings were found possible by revising manpower standards. But the greatest possible savings were found to be the result of improved methods and more adequate tools.

Close cooperation between the industrial engineers making the time studies and the maintenance super-

ner of the plant where there is adequate space for future expansions.

After a study of how to deliver stores materials to the field, it was decided to use tow-trains made of tractor-trailer combinations. These tow-trains are dispatched every 30 minutes on weekdays, and as required during evening shifts and weekends.

Twenty-two receiving stations are located adjacent to operating equipment throughout the plant. Materials delivered by tow-train to these points usually are unloaded by the tractor driver. For heavy material the tractor driver leaves the trailer to be pulled to the job site by the maintenance mechanics.

Emergency material requests are filled by telephone. The foreman or mechanic on duty phones central stores, designating the material he wants by use of a field spare parts catalog kept in the area.

Over 17,000 spare parts are identified with stores stock numbers with picture illustrations for intricate parts. Individual spare parts catalogs for specific plant areas are tailored to cover only the equipment in that area to decrease confusion during phone orders.

When stores receives the phone order, a stock clerk enters all necessary information on a stores withdrawal ticket, routes the ticket to stock pickers who dispatch the material to the loading dock where the orders are segregated by delivery area and towed to the proper field receiving station.

This article is based on the round-table discussion of "Maintenance in Chemical Plants" led by M. C. Hudgins, Stanley A. D'Armond, and B. D. Harrison of the Ethyl Corporation at the 6th National Plant Maintenance & Engineering Conference, January 25, 1955, Palmer House, Chicago, Ill.

---

vision helped to develop most of the job methods.

Labor savings equal to $100,000 on an annual basis were achieved in ten months by four time-study engineers and maintenance supervision. These results were encouraging enough so the time-study work was continued, and its scope widened to cover other than preventive and repetitive jobs.

Turnaround time studies made recently indicate that sizable reductions in downtime are possible by improved methods for scheduling manpower, materials, and tools for the numerous jobs on each turnaround.

Work-and-Delay Studies

The next phase tackled by the industrial engineers was that of a work-and-delay study in the plant garage where all cars, trucks, and other plant mobile equipment items are maintained.

At the start of the study, there were twenty mechanics and helpers. The flow of work was relatively constant with no large backlog.

A several week study consisting of observing the number of men working, the number idle, and those absent from the work area at random intervals of from five to twenty-five minutes was made. At the end of this period, statistically reliable data was obtained, indicating that a reduction of manpower in the garage was possible.

The cause for excess manpower in the plant garage—as shown by the work-and-delay study—was that the garage foreman was too busy ordering spare parts and materials to give proper supervision to his mechanics.

Allowing central stores to order and stock the parts needed by the garage allowed the foreman to spend more time in supervision, and reduced the manpower requirement by four mechanics—a saving of $20,000/yr.

Lost-Time Studies

The success of the time studies and the work-and-delay studies led to another approach—to be used simultaneously with the other methods—for raising general maintenance labor efficiency.

For some time Ethyl people had been considering three basic questions . . . how much of a mechanic's time is spent for productive work? . . . what major factors cause a mechanic to lose time from productive work? . . . what do each of these factors amount to in dollars and cents?

The garage work-and-delay study method was obviously unsuited to the study of a large operating area. Therefore a method of sampling work performance was devised. Studies were made of complete work shifts with a number of mechanics in each of the several crafts within an area of about one-third of the plant.

Detailed time observations were made over a fairly long period. Data taken indicated that production time, time on travel, and lost-time could be segregated into groups.

Lost-time included general subgroups such as the delay waiting for materials, waiting for other crafts to finish their work, waiting for instructions from foremen, and waiting for process unit operations.

While not complete, these lost-time studies indicate that the final results will give an accurate picture concerning the factors delaying maintenance work. The next step will be the elimination of those delays indicated as having an important effect on maintenance labor efficiency.

Applying Results

As has been indicated earlier, the various time study results have been used by Ethyl as the basis for improved job method descriptions, improved scheduling procedures, and the transfer of conflicting duties.

No incentive measures are used to encourage the employes to accept the findings of the industrial engineering section. After a specific procedure is found lacking, the method is studied, changed, reviewed by industrial engineering and maintenance people, and issued as a new job method.

When work orders are written and scheduled, the actual labor hours required are compared with the hours anticipated by the specific job method. Supervision then examines the variance. If the actual time is too long, questions will be asked.

Ethyl is firmly convinced that equipment and building maintenance will continue to provide a fertile field for improvement, and is equally confident that a continued study of facilities, methods, and procedures will give improved service, lower operating costs, and better control of inventory investments.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Dimethyl Sulfoxide

Dimethyl sulfoxide, pronounced "dye-**meth**-ihl sulf-**ox**-side," is a new petrochemical about which its producer is unusually enthusiastic. Colloquially known as "DMSO," this chemical is a clear, water-white, high-boiling (372° F) liquid which has little odor and is apparently nontoxic. Itself completely soluble in water, it in turn can dissolve many organic compounds, and is unusually selective in its solubility characteristics for hydrocarbons.

DMSO is accordingly expected to find wide use as a solvent—for the selective separation of paraffinic and aromatic hydrocarbons, for synthetic fibers, for dissolving or separating acetylene and/or other gases, for upgrading lube oil and diesel fuel, etc. The freezing points of its mixtures with water are well below those of ethylene glycol and water, suggesting prospects for use as an antifreeze and as a hydraulic fluid. Other possible uses include paint removers, resin solvents, wire strippers, and the solvent extraction of fatty acids.

Dimethyl sulfoxide is reportedly produced (or is producible) by the catalytic reaction of methanol (CH_3OH) and hydrogen sulfide (H_2S), which yields dimethyl sulfide ($CH_3 \cdot S \cdot CH_3$). This product is then oxidized to dimethyl sulfoxide ($CH_3 \cdot SO \cdot CH_3$). Both methanol and hydrogen sulfide are volume petrochemicals. The first is derived (as reported last month) from the reaction of natural gas or petroleum fractions with steam or air, followed by catalytic reaction of the resultant carbon monoxide and hydrogen. Hydrogen sulfide, in turn, is obtained in large quantities from the desulfurization of natural gas and petroleum fractions.

DMSO is about to go into commercial production, according to recent reports. Its initial price, said to approximate 25 cents per pound, will not entitle it to enter all of the fields rendered possible by its properties, but really large-scale production might reduce this cost to a figure comparable to the costs of ethylene glycol and acetone. Such possibilities certainly make DMSO a very interesting petrochemical.

Methyl Ethyl Ketone

Methyl ethyl ketone, pronounced "**meth**-ihl **eth**-ihl **key**-tone," is a petrochemical which has in recent years found increasing use as a commercial solvent. As its name implies, it has the formula $CH_3 \cdot CO \cdot C_2H_5$. Possessing an acetone-like odor, it is a colorless, flammable liquid with a freezing point well below that of water and a boiling point not far below that of this substance.

MEK, as it is known in the trade, finds its principal use as a solvent for nitrocellulose and vinyl-resin lacquers. Appreciable (and growing) quantities are employed in the solvent refining of lube oils. Additional uses include other resin coatings, rubber cements, cleaning compounds, paint removers, and chemical synthesis. In general, MEK competes with acetone for many of its applications, finding use where the requirement is for a ketone (R-CO-R compound) of lower vapor pressure. Acetone, incidentally, is dimethyl ketone, $CH_3 \cdot CO \cdot CH_3$.

Methyl ethyl ketone is synthesized commercially by the catalytic dehydrogenation (removal of hydrogen) of secondary-butyl alcohol ($CH_3 \cdot CHOH \cdot C_2H_5$); this is similar to the production of acetone from isopropanol. Secondary-butyl alcohol, in turn, is prepared from butylenes by reaction with concentrated sulfuric acid and subsequent hydrolysis (reaction with water) of the butyl sulfates formed. As is common knowledge, the butylenes required are obtained from refinery cracked gases or by deliberate dehydrogenation of n-butane, an LPG or LRG in large supply at refineries and natural gasoline plants.

MEK is already a volume petrochemical—perhaps approaching 200 million lbs./yr. in production. Future growth, as for any production chemical, lies in further development of present uses and in expansion into new fields.

NEWS in VIEWS

FIRST TANK CAR OF CHEMICALS FROM NEW OXO PROCESS UNIT at the Texas City plant of Carbide and Carbon Chemicals Co. Riding on carload of primary amyl alcohols are (l. to r.): Leroy Dampman, area supervisor at Oxo unit; E. J. Fox, plant superintendent; and T. E. Lewis, Oxo unit department head. Carbide's new unit will have capacity of over 60,000,000 lbs. of product a year. Besides primary amyl alcohols, it produces primary decyl alcohols and is designed to make other Oxo chemicals.

Armstrong Paint & Varnish chooses Aluminum Paint to protect its own tank farm
Have you tried aluminum paint on your tanks?

Armstrong storage tank farm (above) has more than 80 steel tanks, some with capacities up to 25,000 gallons. These aluminum-painted tanks contain oils and other liquids used in the manufacture of Armstrong paints in plant shown below.

The Armstrong Paint & Varnish Works, Chicago, Illinois, with over 100 years of experience in paint formulating and manufacturing, uses aluminum paint to protect its own storage tank farm. Armstrong chose its Armorite aluminum paint from among its many types of maintenance coatings because of aluminum's high heat reflectivity, outstanding protection, excellent durability and attractive appearance.

Armstrong uses its own tank farm as a convenient testing ground. The aluminum paint on thousands of square feet of tank surface is exposed to hot sun, industrial fumes, rainfall, snow and ice and is closely checked by Armstrong technicians for durability and protective characteristics.

Using ALCOA Aluminum Pigments, Armstrong produces several types of aluminum paints including asphalt aluminum coatings and heat-resistant and chrome-finish, all-purpose, aluminum paints.

ALCOA does not make paint, but ALCOA Aluminum Pigments are used in more aluminum paints than any other brand. Special formulas have been developed by paint manufacturers like Armstrong to solve individual problems. Paints made to these formulas actually cost less, last longer, give utmost protection against sun, rain, heat, cold, smoke and fumes.

Write today for the latest information on all types of aluminum paint. Use the coupon.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

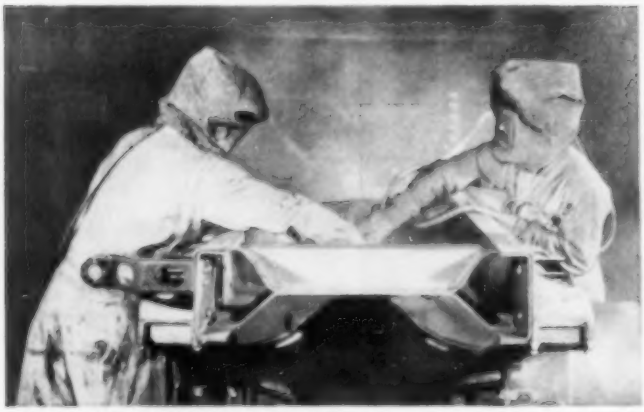
Paint Service Bureau, Aluminum Co. of America
1792-D Alcoa Building, Pittsburgh 19, Pennsylvania

Please send me your FREE BOOKLETS:
- ☐ Painting With Aluminum
- ☐ Aluminum Asphalt Roof Coatings Make Time Stand Still

Name _____
Company _____
Address _____
City _____ Zone _____ State _____

(To obtain more data on advertised products see page 564)

IN PETROLEUM (*Oil and Gasoline Additives*)



IN SURFACE COATINGS (*Paint and Shellac*)

IN CHEMICALS (*Rocket Fuels*)

Enjay helps move products fast

More and more industries in the petroleum, surface coating and chemical fields are relying on Enjay to help move their products fast. For Enjay supplies them with a complete line of uniform, high quality petroleum chemicals that assure dependable product performance and proved results. Enjay is also ready to assist you in developing new or improved products through chemistry. For petroleum chemicals backed by 35 years research, experience and know-how, *next* time, call on Enjay.

Enjay Company, Inc. · 15 West 51st Street, New York 19, N. Y.

PETROLEUM	SURFACE COATING	CHEMICAL
PARANOX	PETROMOL 91	PETROMOL 91
PARATONE	PETROMOL 95	PETROMOL 95
PARAFLOW	PETROMOL 99	PETROMOL 99
PARAPOID	JAYSOL	JAYSOL
PARADYNE	Secondary Butyl Alcohol	Iso-Octyl Alcohol
PARATAC	Secondary Butyl Acetate	Decyl Alcohol
PETROMOL	Isopropyl Acetate	Denatured Ethyl Alcohol
Methyl Ethyl Ketone	Acetone	Tridecyl Alcohol
Dewaxing Aid	Methyl Ethyl Ketone	Dicyclopentadiene
Ethyl Ether	Dicyclopentadiene	Isoprene
Isopropyl Ether	Ethyl Ether	Butadiene
Reference Fuels	Isopropyl Ether	Ethyl Ether
	Naphthenic Acids	Isopropyl Ether
	Iso-Octyl Alcohol	Tetrapropylene
	Decyl Alcohol	Tripropylene
	Denatured Ethyl Alcohol	Aromatic Tars
		Benzene
		Acetone
		Methyl Ethyl Ketone

ENJAY

35 successful years of leadership in serving industry

(To obtain more data on advertised products see page 564)

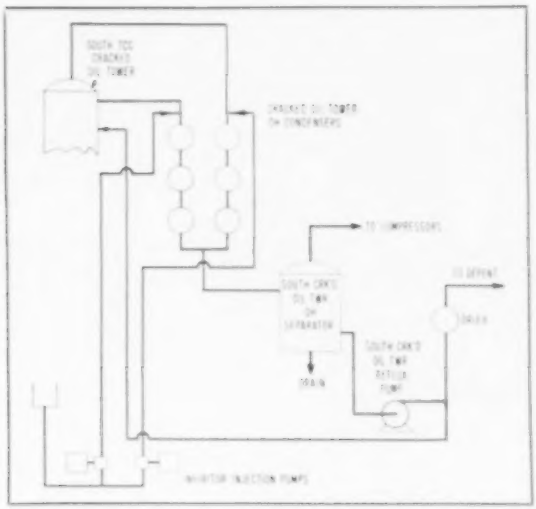


FIG. 1—**SULFIDE CORROSION** in condensers caused shutdowns here

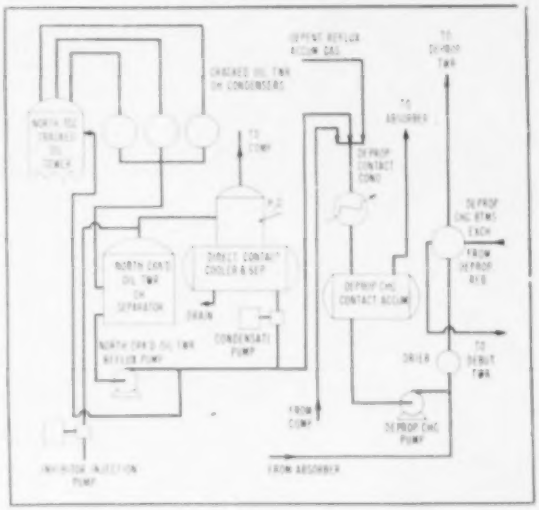


FIG. 2—**CORROSION AND EMULSIONS** in condensers caused shutdowns here

*Inhibitor Stops Corrosion, Emulsion Fouling**

By N. S. BANTA and C. A. MURRAY

A CORROSION inhibitor and a demulsifying compound have been used to solve two serious fouling problems in Pure Oil Co.'s Smith's Bluff Refinery involving heat exchange equipment in TCC units.

In one case it not only eliminated excessive pressure drops, but improved heat transfer and minimized nonscheduled shutdowns. In the other case, product recovery was increased in addition to eliminating fouling.

Case I involved fouling in the overhead condensers serving the cracked oil fractionator, the charge to which consists of 115,800 lb./hr. of hydrocarbons, 4240 lb./hr. steam, 540 lb./hr. H_2S, 860 lb./hr. CO_2 and 2 lb./hr. ammonia. Fig. 1 is a flow diagram of the overhead condensing system. Fouling in the two parallel exchanger banks consisted principally of iron and copper sulfide formation.

While metal loss was not serious—tube bundle life averaged 3 to 4½ years—a rapid buildup of corrosion products in the bundles increased pressure drops so rapidly as to require unscheduled cleaning shutdowns after only three to four months on-stream.

Even though a neutral pH was observed in the condenser steam condensate, the rapid buildup of corrosion products was evidence that ammonia injection was inadequate.

To reduce this corrosion product buildup, a semi-polar organic compound type inhibitor was chosen which is adsorbed from oil solution to form a protective film on metal surfaces. A small proportioning pump started injecting the inhibitor into the overhead stream in September, 1953.

After large initial doses of inhibitor to establish a protective film on the metal, a regular dose of 2 gal./day was established (1 gal. per 4000 bbls. gross overhead plus reflux, or 6 ppm.).

Results have been good. Fouling and pressure drop have been reduced so as to eliminate unscheduled bundle cleaning shutdowns. Fouling observed during inspection after a year on stream has been minor.

Not only is inhibitor injection justified on the basis of fewer shutdowns and extending bundle life, but exchanger heat transfer has been improved by the elimination of fouling. Moreover, protection may extend far downstream of the injection point.

Case II was an emulsion problem developing after facilities were installed to increase cracked oil fractionator condensing capacity on another TCC unit; namely, the addition of a direct contact condenser and separator downstream of the existing overhead separator.

Rapid fouling and increased pressure drop were evident at the coalescing drier and the depropanizer exchanger. The separator water draw also contained entrained gasoline.

Fouling was found to be due mainly to iron sulfide corrosion and silica from the river water used in the contact condenser. The gasoline stream carried emulsion into succeeding equipment, where it was partially broken in the drier, fouling the coalescer. The rest of the emulsion was broken in the depropanizer preheater, also leaving a fouling deposit.

The affected portion is shown in the Fig. 2 flow diagram. Gasoline and lighter leave the tower in three parallel streams, each passing through one condenser and then joining in the overhead separator. The overhead separator feeds a contact condenser and separator. The gasoline streams from the two separators combine and, further on, join the depentanizer reflux gas and gas from first and second stage compressors. Then they enter successively the depropanizer charge contact condenser, accumulator, coa-

* Adapted from a paper, "Corrosion Inhibitor Injection—Anti-Fouling as well as Corrosion Protection Measure," presented at Western Petroleum Refiners Assn. Regional Meeting, Beaumont, Texas, Feb. 11, 1955. Authors Banta and Murray are with the Technical Division of Pure Oil Co.'s Smith's Bluff refinery at Nederland, Texas.

don't be HALF INFORMED

get a **DEMONSTRATION** of the **Airetool CC-4325**

Become acquainted with the remarkable results obtainable from this condenser cleaner . . . it's the lightest, most flexible and mobile condenser cleaner ever offered on the market!

Say goodbye to bulky, cumbersome condenser cleaning equipment . . . gain new speed in your operations with the feather-light new AIRETOOL CC-4325. It weighs only 11 lbs. and is easily handheld by one man, with no supporting rig required! A high-speed two-stage air motor provides extra power to rapidly and completely clean scaled tubes, even those completely plugged with hardest deposits.

The AIRETOOL No. CC-4325 Condenser Cleaner, and a carbide-tipped drill, form a combination that is really speedy and efficient. The built-in hand-controlled flushing system removes chips from the drill point as you work. A wide variety of drill and brush heads are available to meet every condenser cleaning need . . . they're quicker, safer and thorough in cleaning condenser tubes.

WRITE TODAY for complete details about the CC-4325 and other AIRETOOL Tube Cleaning and Expanding Equipment. Ask for your demonstration appointment!

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

Remember . . .
there's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

REPRESENTATIVES in principal cities of U.S.A., Canada, Mexico, South America, England, Japan
BRANCH OFFICES: New York, Chicago Philadelphia, Tulsa, Houston, Baton Rouge

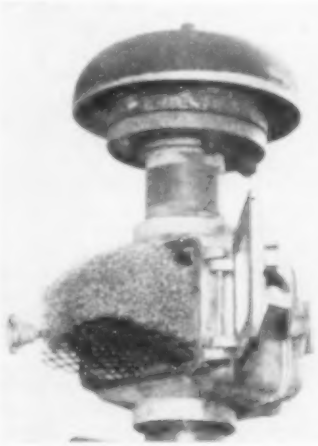
lescer and depropanizer exchanger.

The stream consists of 107,200 lb./hr. hydrocarbons, 3850 lb./hr. steam, 290 lb./hr. H_2S, 470 lb./hr. CO_2 and 2 lb./hr. ammonia. While the latter provides a neutral steam condensate stream, it is insufficient to inhibit sulfide corrosion.

Emulsion elimination was obtained by injection of a demulsifying chemical with a corrosion inhibitor on a continuous basis with a small proportioning pump. After initial large doses to establish a protective film, the regular dosage was set at 2 gal./day (1 gal. per 4000 bbls. gross overhead plus reflux product, equal to 6 ppm.).

Impressive improvement followed chemical injection. Separator water was oil-free, entrained water was eliminated from the gasoline stream, and short time pressure increase and loss of heat transfer were eliminated along the depropanizer feed stream. There has been no further serious equipment fouling in the past 18 months of operation.

Economic justifications not only accrue by the elimination of unscheduled shutdowns, but the reduced water in the depropanizer feed stock has improved the operation of this tower.



ENTRAINMENT TRAP is plant-made

Modified Flame Arrestor Reduces Product Losses

DURING a cycle—lasting several days—of air blowing a medium viscosity mixture at Esso Standard Oil Co.'s Bayway refinery, Linden, N. J., about 3 to 4% of the material was lost by physical entrainment.

The process—a combination of air agitation and air stripping-sweetening—is performed in a standard cone roof tank about 10 ft. in diameter and

(To obtain more data on advertised products see page 564)

GENERAL REFRACTORIES

FILET MIGNON—a la BRICK Sizzling, savory, juicy—dripping with butter—dashed with Worcestershire—and all of it brought to your table because of brick—refractory brick.

Refractories that contain the flames of industry. That produce the steel for your stove, your cabinets, your cooking utensils . . . provide the heat for the oven, the cold for the refrigerator . . . make rails, cars and engines which bring your steak to town; the wheels, body and motor of the truck which delivered it to the butcher. The platter on which it is served. The knife to cut it. The fork to eat it. The lights for the table. All—born of refractories.

Practically everything made or moved requires refractories. Refractories of almost infinite variety, prescribed and tailored for each special task.

Developing them, producing them, applying research to their improvement, drawing on resources all over the world, is the complete refractories service that we provide to industry, everywhere.

GENERAL REFRACTORIES COMPANY
PHILADELPHIA 2

A COMPLETE REFRACTORY SERVICE

LITECAST-50—A hydraulic setting light weight castable having a density of approximately 50 lbs. per cu. ft. Available in regular mix and pneumatic gun mix.

HIGH-STRENGTH BRIK-CAST—A hydraulic setting clay base castable having exceptionally high strength. Available in regular, pneumatic gun mix and trowel mix.

GREFCO CASTABLES are manufactured at 4 strategically located plants in Pennsylvania, Missouri, Texas, and California.

Like to try it?

Ever wished you could try out a Brookfield Viscometer right in your own Lab or plant? With your materials and your problems? At absolutely no risk? Now you can do just that! Send for simple details of Brookfield's Free Trial plan. Write today.

WITH A

Brookfield

SYNCHRO-LECTRIC

VISCOMETER

. . . you make determinations directly in centipoises. Just flip an switch and read the dial. It's as easy as taking temperature readings. Availability of single and multi-speed models, and special accessories, enables accurate work with both Newtonian and non-Newtonian materials. Effective range: 1 to 32,000,000 CPS.

See for yourself, at no risk of any kind, how a Brookfield Viscometer can save you time, trouble, dollars. Write Dept. W.

Brookfield Engineering Laboratories, Inc.
240 Cushing Street, Stoughton, Mass.

NEW WACHS PORTABLE POWER SAW

No Flame—Safe Cuts Under Hazardous Conditions!

FASTER—SAFER—ACCURATE!

Cuts 2", 4", 6" & 8"
Cast Iron and Steel Pipe

WACHS GUILLOTINE SAW FACTS—

- Cuts Fast
- Cuts Clean
- Cuts Square
- Height 28"
- Width 22¼"
- Depth 12"
- Set up time, less than one minute
- Power—electric or air motor
- Weight 105 pounds

For further information write to:

THE E. H. WACHS COMPANY
1925 N. Dayton Street • Chicago 22, Illinois

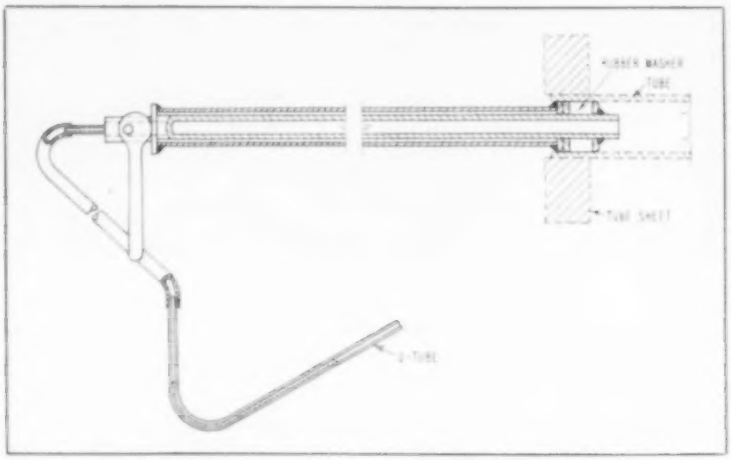
about 30 ft. high. The tank is about three-fourths full of a petroleum fraction which must be air blown for sweetening.

Physical entrainment of the material out of the top of the tank—due to the high air velocities needed to effect satisfactory stripping—not only meant a loss of material, but resulted in material overflowing on the tank roof creating a housekeeping problem.

Commercial entrainment separators with slanted baffles were tried, but did not materially reduce entrainment.

The solution was found in removing the perforated plate from a standard flame arrestor and replacing it by a four inch thick pad of crinkle-wire mesh supported by a perforated plate. Not only did this effectively stop all entrainment, but it allowed air rates to be increased to 15,000 cu. ft./hr.

Now the Bayway people plan to equip all of their tanks in this type of service with the crinkle-wire mesh screen in a modified flame arrestor.



U-TUBE TESTER and exchanger tube connected for leak-testing

"U" Tube Tests Exchanger Tubes

IN testing heat exchanger equipment it is common practice to pressure the shell side in order to detect any possible leakage through the open-ended tubes. In long bundles it is possible for a small leak occurring in the mid section of the tube to escape detection by the tester.

The "U" tube testing rig shown above was devised at the Sun Oil Co.'s Marcus Hook, Pa., refinery to detect small leakages with air pressuring on the shell side. The rubber washered end is inserted in the tube to be tested and the seal made by expanding the rubber washers with the eccentric lever. Any build up in pressure is quickly reflected by the liquid level in the open end of the "U" tube. The "U" tube insertion or removal operation is performed by the single action of the lever.

What Steels for Heater Fittings?

Problem: What are recent developments in the use of materials for high temperature heater fittings?

Discussion: It is not clear what is meant by heater fittings, unless the reference is to return bends in heater boxes and furnaces, in pipe stills, and in cracking coils; as well as tube supports and hanger rods. There have been no recent developments in the use of new materials for these services.

Generally, 4-6% chromium steel has proved to be satisfactory for the tube turns in the radiant section of pipe stills operating around 650° F., where the tube wall temperature may approach 1000° F.

For return bends in cracking coils, maintained at temperatures of 1100 to 1300° F., stabilized austenitic stainless steels of the 18-8 type have demonstrated useful and economic life. The tube supports and hanger rods are usually constructed of 25-20 Cr-Ni composition of stainless steel (Type 310). For burners and steam-out nozzles, carbon steel has proved to be adequate.

(To obtain more data on advertised products see page 564)

high quality product

boost average ratings as much as 2 octane numbers with the

Ljungstrom® Air Preheater

With waste heat recovered and returned to the furnace in combustion air, the most modern heat-transfer systems can be operated at peak efficiency.

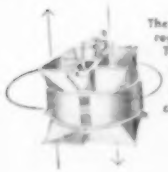
That's why you boost product quality with the Ljungstrom Air Preheater. It's heat-recovery efficiency makes possible advanced furnace designs that assure remarkably close control of processing. And finer control means a more uniform product . . . with average ratings as much as 2 octane numbers higher. One still's added income just from higher product quality is $58,000 annually.

HOW FAST IS "WRITE-OFF"?

In earnings from higher octane ratings, many refiners write off the cost of the Ljungstrom installation in less than two years. This time is cut to *nine months and even less*, when the other Ljungstrom advantages are taken into account — saves up to 20% in fuel costs . . . permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . and minimizes slag.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits obtainable in fuel burning equipment — call or write The Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom



The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transfered from the waste gases to the incoming cold air.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

to remove

H_2S

CO_2

use

Monoethanolamine

Diethanolamine

high purity
NITROGEN DIVISION
chemicals

Maximize the purity of your gas stream, and minimize corrosion problems by using Nitrogen Division gas-treating chemicals. Free of unwanted chemical impurities – chlorides and acids – these products are consistently above standard purity specifications.

Call or write today for samples and quotations. Ask too for technical service to help adapt these high purity chemicals to your process.

NITROGEN DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
Hopewell, Va. • Ironton, Ohio • Orange, Tex. • Omaha, Neb.

to remove

H_2O

use

Diethylene Glycol

Triethylene Glycol

high purity
NITROGEN DIVISION
chemicals

Maximize the purity of your gas stream, and minimize corrosion problems by using Nitrogen Division gas-treating chemicals. Free of unwanted chemical impurities – chlorides and acids – these products are consistently above standard purity specifications.

Call or write today for samples and quotations. Ask too for technical service to help adapt these high purity chemicals to your process.

NITROGEN DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
Hopewell, Va. • Ironton, Ohio • Orange, Tex. • Omaha, Neb.

Anhydrous Ammonia • Ammonia Liquor • Ammonium Sulfate • Sodium Nitrate • Methanol • Urea
Ethanolamines • Ethylene Oxide • Ethylene Glycols • Formaldehyde • Nitrogen Tetroxide
Nitrogen Solutions • U.F. Concentrate—85 • Fertilizers & Feed Supplements

PERSONALS

R. C. McCurdy, president of Shell Chemical Corp., has been elected to the board of Shell Oil Co. McCurdy has been the chemical company's president since 1953. He joined the Shell Oil as a production engineer in 1933 after his graduation from Stanford University. He was named exploitation engineer at Los Angeles in 1939 and became chief exploitation engineer in 1943. Two years later he became manager of the San Joaquin, Calif., production division.

Mr. McCurdy

McCurdy joined a Shell group company in Venezuela in 1947 and became general manager there in 1950.

C. C. Crawford, formerly president of Crawford Chemical Co., Bartlesville, Okla., has joined the Husky Oil Co., where he will conduct studies in the field of petrochemicals.

Prior to his association with Crawford Chemical he worked with the chemical division of Phillips Petroleum Co. and, from 1948 to 1951, was president of a Phillips subsidiary. Crawford, a graduate of Arkansas College, also holds an M.S. in chemistry from Emory University and a Ph.D. from Yale University.

Dr. Fred H. Poettmann has been named the engineering supervisor of Ohio Oil Co.'s research laboratory to be located near Denver, Colo. Poettmann was born in Germany and came to the United States as a child. Later he received a Sc.D. degree in chemical engineering from the University of Michigan.

He has worked for the American Gas Association and the Lubrizol Corp. in Cleveland, and the Phillips Petroleum Co. in Bartlesville, Okla., where he was chief of the production research section. He joined Ohio Oil Co. in January of 1955.

Thomas P. Simpson has been elected vice-president and director of manufacturing of the General Petroleum Corp., succeeding **Gale L. Adams,** who has retired after 29 years with the company.

Simpson began with the company as a chemical engineer in 1924, shortly after his graduation from the California Institute of Technology. In 1935 he was transferred to the Socony-Vacuum Oil Co., Inc., as chief development engineer of the laboratories. In 1947 he became director of the Socony research and development department.

Upon his return to General Petroleum in 1953, he became asst. director of manufacturing.

Bill Wadt, formerly general superintendent at Esso Standard Oil Co.'s Bayonne, N. J., refinery, has moved to the company's New York sales division headquarters at Pelham, N. Y., on rotational assignment. He has been replaced at Bayonne by **Dave Edwards,** who was the asst. general superintendent. Edward's post has been assumed by **Warren C. Wilson,** who moved from the same job at the Bayway refinery.

Mr. Wadt

Mr. Edwards

Mr. Wilson

Wadt began with Esso at Bayonne after receiving his M.S. from M.I.T. in 1933. Except for a 3-yr. period at Bayway and New York, he has been serving at Bayonne. He was made general superintendent in 1953.

Edwards took his bachelor's and master's degrees in chemical engineering at Louisiana State University. He earned his doctorate at the University of Pittsburgh. He began with the company in 1926 and worked at Bayonne and Eagle refineries. In 1935 he was transferred to Baton Rouge as head of the refinery laboratory control group. He rose to asst. head of petroleum products operations at Baton Rouge, and in 1953 was transferred to Bayonne as asst. general superintendent.

A graduate of the University of Michigan with a degree in chemical engineering Wilson started the same year (1933) at the Bayway refinery as a pipefitter helper, utility man and instrument repair man. From there he was made asst. supervisor in process control, then, in 1940, asst. department head. In 1950 he became asst. process superintendent. He was promoted to asst. general superintendent in 1953.

James N. Gorringe, formerly coordinator of executive development for Esso Standard Oil Co., has been appointed employee relations manager. The new coordinator is **Jason Cooper, Jr.,** who was previously asst. manager of employee relations.

Gorringe became a full-time employee of the company in 1937. He held several positions at company refineries, including assistant process superintendent at the Bayonne, N. J., plant.

Cooper joined the company in 1927 and served in a number of personnel and merchandising jobs. He became asst. employee relations manager in 1950.

J. W. Young has been chosen secretary of the refining committee in the Petroleum Division of the American Society of Mechanical Engineers. Young is a member of the engineering division at Humble Oil & Refining Co.'s Baytown, Texas, refinery. **J. P. Mooney,** another Humble Oil engineer, continues as chairman of the committee.

Dr. I. Bergsteinsson has been appointed senior market research and development engineer for Brea Chemicals, a subsidiary of the Union Oil Co. of California. He received his B.S. and master's degree from the University of Saskatchewan and his doctorate from Stanford University in 1934.

From 1934 to 1942 Bergsteinsson was a senior chemist for the Shell Development Co. He was a director of research for the Yale Oil Co., Billings, Mont., from 1942 to 1944, at which time he joined Union Oil Co. as a chemical market analyst and senior research chemist.

Fred B. Behrens has joined Richfield Oil Corp. as staff asst. to David E. Day, vice-president and manager of the manufacturing and pipe line dept.

Behrens first entered the oil business in 1928, at Universal Oil Products Co., after receiving a B.S. in chemistry from the University of Wisconsin. He transferred to Wilshire Oil Co. in 1936 as asst. refinery superintendent and was promoted to

vice-president in charge of manufacturing in 1951, where he remained until his change to Richfield.

Waitman M. Flowers, president of Sinclair Research Laboratories, Inc., has been elected a director and vice-president of Sinclair Refining Co.

Mr. Flowers

Mr. Scott

Flowers' first job with Sinclair was as a data clerk in the cracking division of the research and development department at East Chicago. Two years later, in 1930, he was transferred to the cost division of the department.

During World War II he served as an assistant to E. W. Isom, vice-president in charge of research and development of Sinclair Refining Co. In 1945, he became assistant to the head of the division handling cracking, light oil products, process design and economics research, and was promoted to chief of the economics research division in 1947.

Flowers was moved to New York in 1950 as assistant to the research and development vice-president. In 1951 he became executive vice-president and member of the board of the Sinclair Research Laboratories at the time of its organization. The following year he became president of the research company.

John A. Scott has been elected president of Sinclair Chemicals, Inc., the petrochemical subsidiary of Sinclair Oil. Scott has been executive vice-president and a director of the firm since its organization in 1952.

He joined the Sinclair Refining Co. in Chicago as a research technologist in 1934. From 1945 to 1951 he served as assistant to the research and development vice-president. Scott became manager of the petrochemicals division of the refining company when it was formed in 1951.

Robert S. Knight has been appointed industrial relations manager of the petrochemicals plant at Lima, Ohio, currently under construction by Standard Oil Co. (Ohio) Knight joined Sohio's home office industrial relations department in 1948. He was personnel research asst. from 1950 to 1952, and senior personnel asst. at the Lima refinery after 1952.

Robert Thomas, Fred Banes and **Harold Rose** were appointed asst. directors in three areas of chemicals research by the Esso Engineering and Research Corp., known formerly as Standard Oil Development. The three belong to the chemicals research div.

Thomas, named to exploratory chemicals research, joined the company in 1929 after receiving a chemistry degree from Virginia Polytechnic Institute. He was, with William Sparks, the co-inventor of Butyl rubber, and formerly the director of the new products development lab.

Banes, who has been appointed to chemicals process research work, received his doctorate from the University of Illinois and joined the company in 1943.

Chemicals product development activities are the area in which Rose has been assigned to work. He came to Esso Laboratories in 1942 from a teaching post at the University of Kentucky. About a year ago he was transferred to Enjay Labs and now moves from there to Esso Engineering.

Paul Smith and **Walter Guyer** have been promoted to section heads in chemicals process research. Williams is the unit's organic research head. He received his doctorate from the University of Illinois and joined the company in 1946.

Guyer, now the section head responsible for Oxo process research came to the company in 1940 as a member of products research div. He received his Ph.D. in physical chemistry from Princeton.

Donald Buckley has become a section head for research on Butyl rubber in the chemicals product development group. He joined the company in 1942 after receiving B.S. and M.S. degrees in chemistry from Canisius College.

Raymond Newberg, also assigned to chemicals product development, is responsible for research in plastics, Paracril-S and polyisobutylene. He obtained his B.S. and M.S. degrees in chemical engineering from the South Dakota State School of Mines.

Richard Robey has been made responsible for the chemicals research div.'s analytical work. He joined SOD in 1937 as a research chemist. He holds B.S., M.S. and Ph.D. degrees in chemistry from Ohio State University.

P. J. Byrne, Jr., has been named manager of the Esso engineering department's new coordinating unit, established in a recent reorganization of the entire department. Mr. Byrne has been with the company since 1927, and has served, since 1937, as assistant and then associate chief engineer.

His assistants in the coordinating unit—known as the manager's office—are **C. T. Harding,** assistant chief engineer since 1949, **Luther B. Martin,** named assistant chief engineer in January, and **John W. Packie,** chief design engineer since 1951.

The department's reorganization has meant the creation of three separate divisions: the economics division, which has **Maurice W. Mayer** as director, the design division, with **Channing C. Nelson,** and the mechanical division, with **Allen J. Ely.**

Mr. Mayer joined the company in 1945 as a senior project engineer after 14 years with the Humble Oil & Refining Co. Dr. Nelson began with Esso in 1939. He has been supervising engineer in the process design division since 1951. Mr. Ely has been chief mechanical engineer since 1946. He has been with Esso since 1919.

Fred L. Hartley, formerly manager of commercial development of research for Union Oil Co. of Calif., has succeeded **Claude E. Swift** as vice-president in charge of research and process. Swift has retired.

Hartley has been with Union Oil for 16 years as manufacturing process supervisor in charge of process design. He was named manager of a new commercial development division established by the company in 1953 after serving the previous three years as general superintendent of operations at Union's Los Angeles refinery.

Personals in Brief

Dow Chemical Co.—

New personnel in the Texas division at Freeport: **H. W. Hyde,** chemist in the organic pilot plant laboratory; **D. R. Allen,** chemist in the chemical engineering department; **W. L. Howard,** chemist in the organic basic research laboratory. Joining the student training program as research and development engineers are **G. E. Lippman, G. I. Kennedy, Jr., K. E. Musch,** and **W. F. Wroth. O. E. Heady** joins the organic process development laboratory as a research and development engineer, transferring from Dow's Rocky Flats plant. **J. E. Capps** begins with the company as a technician in the organic pilot plant laboratory.

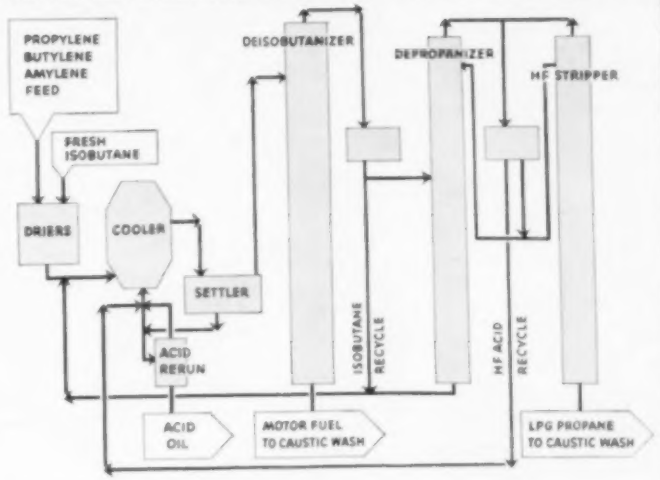
Great Northern Oil Co.—

Richard P. Jeffery, for 22 years

Get the advantages of

PERCO HF ALKYLATION

PERCO HF ACID ALKYLATION PROCESS FOR MOTOR FUEL PRODUCTION



Liquid feed, containing olefins and isobutane, is passed through driers and fed into a cooler along with liquid recycle hydrofluoric acid. Hydrocarbons and recycle acid then flow to the settler. The acid phase is recycled to the cooler. The hydrocarbon phase is fractionated to separate high octane motor fuel alkylate from recycle isobutane.

Meet the increasing demand for higher octane motor fuels with Perco HF Alkylation. A Perco plant is exceptionally economical to install and operate. Find out how Perco HF Alkylation increases octanes and profits. For complete information consult Perco today.

Here are 10 benefits you get with PERCO

1 High octane and high blending value.

2 High yield of motor fuel per barrel of olefin.

3 Odorless, clean-burning fuel.

4 Creates no gum problem in any blend.

5 Simplicity for low investment and low operating costs.

6 Removes high volatility isobutane from motor fuel.

7 Low acid consumption.

8 Safety record equal to other refining units.

9 High on-stream factor.

10 High efficiency through infrared analyzer control.

PERCO *Division*

Phillips 66

PHILLIPS PETROLEUM COMPANY

BARTLESVILLE, OKLAHOMA

PERCO®

® A SERVICE MARK

(To obtain more data on advertised products see page 564)

DOMOTOR DOES MORE
IN THE ACCURATE, AUTOMATIC CONTROL OF HARD-TO-HANDLE FLUIDS

Is your problem the precise control of erosive and corrosive fluids at high or low temperatures?

If so, investigate the ANNIN DOMOTOR control valve, wherein internally controlled differential pressures, acting across a sealed-in piston, provide the motive power for operation. The DOMOTOR combines powerful valve action with exceptional stability, greater plug travel and guaranteed positioning accuracy of 1/1000 of valve travel.

Standard models withstand pressures to 5,000 psi with special applications to 50,000 psi. Effective temperatures from −325°F to 1200°F.

Other models by Annin—
Solenoid-operated, Model 1520
Handwheel Valve, Figure 15

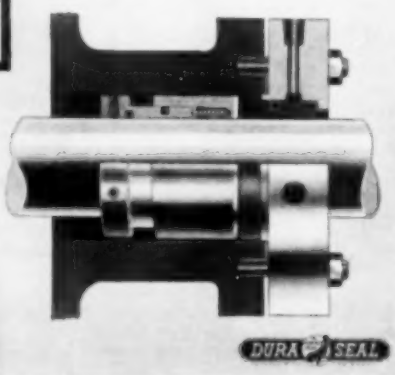
Write today for Catalog 1500B

ANNIN *Control* **VALVES**
THE ANNIN COMPANY
6570 E. Telegraph Road
Los Angeles 22, California

DURA SEAL
TYPE-P.S.

A Single Balanced Mechanical Seal for Light Hydrocarbons at High Pressures...

Now – perfect sealing for pumps handling light hydrocarbons up to 600 lb. pressures. Can be installed on your present equipment – no special sleeves or machining required.



Write Today FOR DETAILS – ASK FOR BULLETIN NO. 455-PP

Send your sealing problems to us for free counsel

DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN

with Globe Oil and Refining Co., to maintenance superintendent.

Humble Oil & Refining Co.—

In the Baytown, Texas, refinery's research and development division: **R. M. Love** to section head, and **O. H. Dawson** to senior research chemist. In the refinery's technical service division: **E. R. Gurtler** to technical specialist; **D. C. Clark, Bartlett Johnston, J. T. Moody,** and **W. K. Roquemore** to senior chemical engineer. In the maintenance department of the engineering division, **Allen L. Lewis** to mechanical engineer. **H. B. Snider** to head of the utilities department, from general foreman of utilities, power and water in the mechanical utilities department.

Shell Oil Co.—

Management of the Anacortes, Washington, refinery is as follows: **R. W. McOmie,** refinery manager, from manager of the Wilmington, Calif., refinery; **R. C. Barton,** superintendent, from the same post at the Martinez, Calif., refinery; **H. S. Hicks,** asst. superintendent, from department manager-catalytic cracking at Wilmington.

J. H. McCarty, chief engineer, from superintendent-construction at Norco refinery; **C. A. Rehbein,** chief technologist, from special technologist of the manufacturing technological unit at the company's head office; **H. W. Beckman,** treasury manager, from same post at the Sewaren plant.

P. E. Malson, department manager of Zone A, from department manager-dispatching at the Wood River, Ill., refinery; **B. W. Dunbar,** department manager of Zone B, from department manager-catalytic cracking, Wood River; **D. W. Glendinning,** department manager of Zone C, from department manager-control laboratory at Wilmington; **G. F. Mayse,** department manager of Zone D, from department manager-fire and safety, Wilmington.

W. F. Gallagher, asst. chief engineer, from senior engineer at Martinez; **C. T. Magin,** chief chemist, from asst. department manager-control laboratory at Wilmington; **J. E. Brewer,** department manager, stores, from asst. department manager-stores at Wood River; **A. D. Northcutt,** department manager, personnel and industrial relations, from the same job at the Wilmington refinery.

Standard Oil Co. (Ind.)—

Donald H. Ernest to the staff of the Whiting Research Laboratories. Ernest has been with Universal Oil Products Co. and the Franklin Supply Co.

Tank Farm . . . *ideas grow into insulation specifications at this unique testing unit*

To study scientifically the effects of weather on insulations and protective finishes, Armstrong recently built a unique outdoor Tank Farm. Here, new and old insulation specifications and materials are evaluated under field operating conditions. Both high and low temperatures are held in a variety of pressurized, commercial and domestic oil tanks, and in a wide assortment of pipe lines.

The Tank Farm's equipment is extremely flexible so that insulation can be applied by one method and, if desired, replaced at any time to meet a completely different specification. Tests indicate which materials and methods warrant further development to replace current specifications.

This Tank Farm is but one example of how Armstrong Research is constantly working to improve industrial insulation materials and to develop simpler, more economical specifications. For full details on the Armstrong Line of industrial insulations and complete Contract Service, call your nearest Armstrong office or write Armstrong Cork Company, 206 Stratton St., Lancaster, Pennsylvania.

Study of new insulations, finishes, and methods of applying them is a continuous program of Armstrong Research. A new specification for applying corkboard is being made ready for testing on this experimental low temperature tank.

Armstrong INDUSTRIAL INSULATIONS

To make your bid for the growing diesel fuel market more competitive . . .

Du Pont FOA-2 helps you stabilize cracked distillates—at lower cost—for use in diesel fuels.

With the railroads concentrating on reducing operating costs, you are probably faced with the problem of producing—from existing stocks—more diesel fuel at lower cost.

To solve this problem profitably, you can use Du Pont FOA-2 to stabilize cracked distillates and overcome incompatibility between blends of cracked and straight-run stocks. And you'll find this additional flexibility will help you keep your heating oil stocks in better balance to meet varying seasonal demands.

Many leading railroads are using No. 2 fuel oils containing Du Pont FOA-2, with excellent results. They have found, after careful testing, that they can efficiently operate diesel engines on well-stabilized cracked distillates at lower cost, and without harmful effects.

Good filterability

Because of the excellent dispersant action of FOA-2, it helps you to bypass most filter plugging problems. And being an ashless, nonmetallic additive, Du Pont FOA-2 does not contribute to the exhaust stack sparking problem.

Economical

Du Pont FOA-2 is effective in low concentrations—extremely economical to use. And you need no special equipment to add it.

Ask for samples

Your laboratory can easily test the effectiveness of FOA-2 in your own stocks. For samples and technical information, contact your Du Pont Petroleum Chemicals Division representative or regional office.

DU PONT

Reg. U.S. Pat. Off.

Better Things for Better Living . . . through Chemistry

Petroleum Chemicals

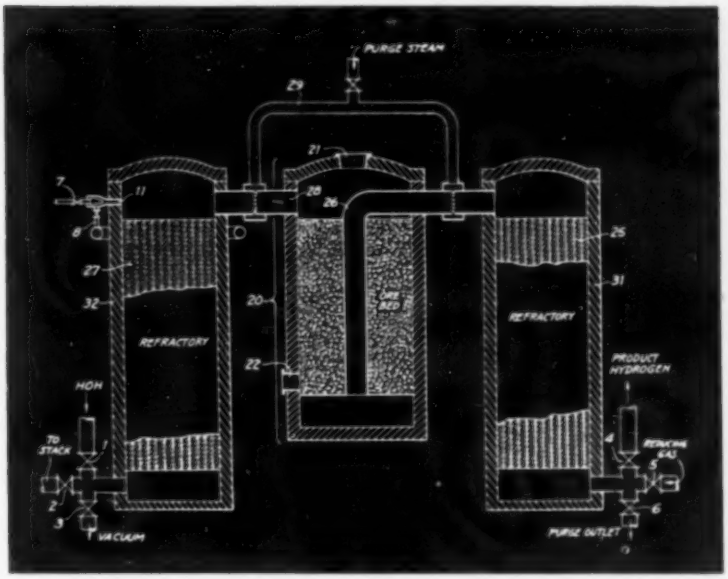
E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

Regional Offices:

NEW YORK, N. Y.—1270 Ave. of the Americas	Phone COlumbus 5-2342
CHICAGO, ILL.—8 So. Michigan Ave.	Phone Kinsdale 6-8630
TULSA, OKLA.—P. O. Box 7391	Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg.	Phone Blackstone 1151
LOS ANGELES, CALIF.—612 So. Flower St.	Phone MAdison 5-1691

IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division, 80 Richmond St. W., Toronto 1, Ont.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Building, 4529—Wilmington 98, Delaware

By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.



APPARATUS for producing hydrogen through reduction by iron ore

CO-Free Hydrogen Can Be Made By Using Waste Thermal Cracking Gases

HYDROGEN has been produced commercially by passing steam over a reducing material such as iron ore. A relatively pure hydrogen is liberated and the oxygen combines with the iron to form iron oxide. This oxide, then, is reduced by water gas containing around 50% hydrogen and about the same amount of carbon monoxide, so that the hydrogen from the process always is contaminated with some carbon monoxide.

In U. S. patent No. 2,635,948, issued to Eastman Kodak Co., a fairly pure commercial hydrogen of 83% to over 99% concentration is produced fundamentally free from carbon monoxide by using a reducing gas free of carbon monoxide, such as the waste gases obtained from thermal cracking. These contain around 10-20% hydrogen, the balance being principally nitrogen. Runs are described wherein a lean reducing gas containing 12.7% hydrogen and 87.3% nitrogen is employed. A typical average gas composition taken during the oxidation cycle is shown in table at right.

If natural iron ores are used, they should be as free as possible from iron sulfides to avoid contamination.

The illustration describes a regenerative apparatus which, with an ore bed of about 4-ft. diameter and 10-ft. high, can generate upwards of 100,000 C. F./day of hydrogen with excellent heat economy. The iron ore unit, 20, contains the ore bed, through the center of which is conduit 26. Regenerators 25 and 27 are of checkerwork and contain elongated narrow passageways of silicon carbide refractory. The ratio of area on any cross section of slot to area of refractory is 1:3 to 1:4. The ratio of the surface of any one of the passageways expressed in square feet to the volume of the passageways expressed in cubic feet is greater than 30. Burner 11 preferably is of the type described in patent No. 2,183,596.

In operation, the apparatus is brought up to the desired temperature (900° C.) by supplying heat from burner 11 and temporarily through manhole 21. Assuming that reduced metal is contained in unit 20, valves 2, 3 and 5 being closed and valves 1 and 4 being open, steam is introduced through valve 1, passed through elongated slots of regenerator 27 and rapidly given a temperature of 900° C. Next it is sent through conduit 28 into contact with the ore bed in unit 20. During passage of steam through the ore bed, hydrogen uncontaminated with CO and of a concentration of at least 80% is generated with the evolution of considerable heat. This hot hydrogen moves through conduit 26 into regenerator 25, where the hydrogen quickly gives up its heat to the elongated passageways in regenerator 25. The final hydrogen is emitted through valve 4 to a gas holder.

CO_2	0.6%
Unsaturates	0.0
O_2	0.2
CO	0.0
H_2	96.8
N_2	2.4

After this oxidation cycle has continued for such a period that the metal has become converted to oxide in unit 20, valves 1 and 4 are closed and valves 2 and 5 are opened. The lean CO-free reducing gas then is introduced at 5 and, during its passage through regenerator 25, takes up the heat from unit 25 and passes via conduit 26 into contact with the ore bed in unit 20. This hot lean gas restores the oxide to the metallic condition without contaminating the metal with CO. The used lean reducing gas escapes through conduit 28 into contact with regenerator 27, which subtracts such useful heat as may remain therein. Finally, the lean reducing gas escapes to the stack through conduit 2.

Savings in Desulfurization With Recycle Hydrogen

IT IS pointed out in U. S. patent No. 2,567,252, issued to Anglo-Iranian Oil Co., that it is a well-known idea to carry out desulfurization of petroleum oils by passing them over a catalyst in presence of hydrogen at 1000° F. and 200 atmospheres pressure. The patent claims that economies can be effected simply by recycling the hydrogen-containing hydrogen sulfide to the process. What is more, contrary to expectations, the hydrogen sulfide does not tend to build up in concentration in the hydrogen.

If the conditions are carefully controlled, the concentration built up generally will not exceed 2%, which concentration has no appreciable effect on the desulfurization reaction, and the whole of the H_2S thereafter formed during the reaction will be dissolved in the feedstock.

Using a molybdenum trioxide catalyst deposited on alumina, a tempera-

ture of 750° F., and 1000 psi. pressure, a sulfur removal of 94% was effected, with the catalyst still remaining active.

LPG Corrosiveness Cut By Mercaptide Treatment

ONE of the most serious problems in connection with liquefied petroleum gases is their corrosiveness. This is generally the result of sulfur in some form, particularly free sulfur, which is inherently present in the gases or which may be formed by the decomposition of sulfurous compounds.

In U. S. patent No. 2,669,420, issued to Standard Oil Co. (Ohio), it is claimed that this corrosiveness may be materially reduced and in most instances completely eliminated, at least so as to give a zero result in the Sohio corrosion test described in the patent. This is accomplished by treating the LPG with lead or zinc mercaptide, which may be conveniently impregnated on a carrier clay.

Activators Said to Boost Dimer Yield of Propylene

YIELDS of dimers of 70 to 80% from propylene can be obtained by use of "dimerization activators" such as aluminum trimethyl, according to U. S. patent No. 2,695,327 issued to Karl Ziegler and Hans Gelbert of Mulheim an der Ruhr, Germany. A temperature of 200° C. and pressure of 170 atmospheres were employed. The dimer was mainly 1-methyl-1-propyl-ethylene, in a very pure state. Other alpha olefins are claimed to react similarly.

The patent, which is said to be controlled by the Hoechst interests, shows that higher ethylene polymers also may be obtained. In fact, promoters such as aluminum triethyl, together with materials such as organotitanium compounds, are claimed to give polyethylenes of exceptionally high molecular weight at low pressures, making them suitable for replacing polystyrene in many applications. It is believed that some half-dozen American companies already have acquired licenses on this process.

Mercaptan Reduction In Saturated Distillates

THE mercaptan content of saturated distillates can be reduced, according to U. S. patent No. 2,694,-034, issued to Universal Oil Products Co., by commingling the distillate with an olefinic hydrocarbon (e. g., styrene) in an amount of 1 to 10% and a phenylene diamine inhibitor of 0.00001 to 0.1%, and by reacting the olefin with mercaptan in presence of oxygen (by standing in storage, for example).

Gasoline Rust Preventives

SINCLAIR Refining Co. points out that rust frequently occurs in gasoline pipe lines, storage tanks, and even automotive equipment because of traces of moisture inevitably present in the gasoline, which may contain as much as .005 to .01% of dissolved moisture after it leaves the refinery. Part of the moisture separates when the gasoline is chilled and settles as a separate liquid phase under the main body of the gasoline.

In patent No. 2,667,408, the company proposes the addition of .5 to 50 lbs. per 1000 bbls. of an oxidized micro-crystalline wax having 34 to 55 carbon atoms per molecule. The wax consists essentially of carboxy acids having a saponification number in excess of 100 and not exceeding 260, an acid number within the range of 70 to 160, and an iodine number of less than about 20.

Patents Issued in February

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U. S. Patent Office for February 1, 8, 15, and 22, 1955, Vol. 691, Nos. 1-4.

PROCESSES

Refining

2,701,267 (Scholven-Chemie Aktiengesellschaft) Process for refining oils containing benzene and/or benzene hydrocarbons by heating under pressure.
2,701,783 (Standard Oil Development Co.) Process for the production of a high quality lube oil, using ammonia-containing extraction solvent.
2,701,784 (Socony-Vacuum Oil Co.) Regenerating mercaptide alkaline reagent by oxidizing certain ratio of light-heavy mercaptides.
2,701,786 (Socony-Vacuum Oil Co.) Cyclic process for continuous percolation of petroleum lubricating oils.
2,702,236 (Phillips Petroleum Co.) Liquid-liquid contacting device.
2,702,696 (Standard Oil Development Co.) Tower plates for operating a countercurrent vapor-liquid processing zone.
2,702,784 (California Research Corp.) Azeotropic removal with acetone of hydrocarbon contaminants from phenol.
2,702,794 (General Motors Corp.) Separation of emulsions with inorganic salt.
2,702,826 (Standard Oil Development Co.) Separation of hydrocarbons by adsorption.

Conversions

Re 23,942 (Houdry Process Corp.) Apparatus for contacting solid materials with fluids.
2,701,184 (Standard Oil Development Co.) Apparatus for carrying out catalytic reactions between hydrocarbon materials.
2,701,185 (Socony-Vacuum Oil Co.) Apparatus for regeneration of solid contact material.
2,701,230 (Standard Oil Development Co.) Hydroforming process and apparatus in fluidized system.
2,701,231 (Standard Oil Development Co.) Catalytic hydrocarbon cracking starting up procedure for high boiling feed stocks.
2,701,232 (Houdry Process Corp.) Processing liquid hydrocarbons using granular catalyst.
2,701,758 (Metallgesellschaft Aktiengesellschraft) Thermal processes for gasification of solid carbonaceous fuel.
2,701,785 (Socony-Vacuum Oil Co.) Cyclic method for catalytic conversion of hydrocarbons.
2,701,787 (Standard Oil Development Co.) Distillation of oil-bearing minerals (shale).
2,701,788 (The Lummus Co.) Coking of hydrocarbons, using granular particles of heat-carrying material.
2,702,207 (Houdry Process Corp.) Multiple lift for elevating granular solids.
2,702,208 (Sun Oil Co.) Gas lift disengager for granular solids.
2,702,267 (Hydrocarbon Research, Inc.) Hydrocarbon conversion process and the stripping of the fouled catalyst with generation gases containing hydrogen.
2,702,269 (Rutgerswerke-Aktiengesellschaft) Coking or cracking of oils, pitches, and the like.
2,702,288 (Standard Oil Co. Ind.) Ethylene polymerization process using Mo, etc., catalyst.
2,702,434 (Standard Oil Development Co.) Apparatus for countercurrent contacting of fluidized solids with gaseous materials.
2,702,742 (Standard Oil Development Co.) Apparatus for contacting solids and vapors.
2,702,782 (Phillips Petroleum Co.) Hydrocarbon conversion of topped crude by reforming-cracking-extraction (with carbon black furnace).
2,702,827 (Standard Oil Development Co.) Reduction of phosphoric acid corrosion in a polymerization process.

Hydrocarbon Synthesis

2,701,756-7 (The Texas Co.) Manufacture of synthesis gas by treating hydrocarbons with oxygen-containing gas.
2,702,238 (Phillips Petroleum Co.) Apparatus for controlling synthesis reactions.
2,702,240 (Texaco Development Corp.) Reduction of metal oxides and simultaneous production of CO and hydrogen.
2,702,298 (Stanolind Oil & Gas Co.) Separation of organic oxygenated compounds from hydrocarbons.
2,702,814 (M. W. Kellogg Co.) Synthesis of organic compounds.

PRODUCTS

Chemicals

2,701,188 (Knapsack-Griesheim Aktiengesellschaft) Apparatus for the continuous manufacture of acetylene.
2,701,264 (Shell Development Co.) Separation of alcohols and other impurities from ketones.
2,701,266 (Imperial Chemical Industries Ltd.) Separation of p-xylene by crystallization.
2,701,750 (Standard Oil Development Co.) Recovery of diethanolamine and salts.
2,701,780 (Standard Oil Development Co.) Curing synthetic drying oils.
2,701,813 (Houdry Process Corp.) Process for the partial oxidation of olefins to form glycols and esters thereof.
2,702,091 (California Research Corp.) Recovery of molten phthalic anhydride from gaseous reaction products.
2,702,289 (Standard Oil Co. Ind.) Urea adducts of straight-chain 1-haloalkanes.
2,702,761 (Phillips Petroleum Co.) Process for the treatment of fabrics with a vinyl pyridine polymer.
2,702,774 (California Research Corp.) Process of preparation of free flowing composition containing quaternary ammonium germicide.
2,702,783 (Gulf Research & Development Co.) Process of separating mixtures of organic compounds including ethanol, ethyl acetate, MEK, etc.
2,702,798 (Phillips Petroleum Co.) Alkali metal silicates as stabilizers for low temperature synthetic rubber latices.
2,702,817 (California Research Corp.) Process for the separation of isophthalic and terephthalic diesters.
2,702,819 (Phillips Petroleum Co.) Guanidine alkyl aryl sulfonates.
2,702,821 (Shell Development Co.) Substituted dialdehydes and preparation of the same.
2,702,824 (Nitroglycerine Aktiebolaget) Liquid-vapor phase method for producing lower dialkyl sulfoxides from alkyl sulfides.

Fuels

2,700,876 (L'Air Liquide, Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges

Claude) Plant for forcing gas under pressure from the liquefied gas.
2,701,187 (Socony-Vacuum Oil Co.) Color stabilization in fuel oils, using a formaldimine.
2,701,754 (Standard Oil Development Co.) Anti-stalling motor fuel containing branched chain bifunctional compound having 6-21C atoms.
2,701,949 (A. V. Roe Canada, Ltd.) Catalytic monofuel decomposer system and method.
2,702,080 (Texaco Development Corp.) Burner assembly for flow-type gas generators.
2,702,419 (Ethyl Corp.) Process of casting alkali metals.
2,702,743 (Koppers Co., Inc.) Method and apparatus for preheating gaseous and vaporous reactants in powdered fuel gasification.
2,702,744 (Koppers Co., Inc.) Gasification of powdered fuel and use of a protective gas.

Lubricants

2,701,237 (The Texas Co.) Extreme pressure lubricant including lead naphthenate, sulfo-chlorinated sperm oil, chlorwax, etc.
2,701,803 (Socony-Vacuum Oil Co.) Synthetic lubricants containing Si.
2,702,237 (Standard Oil Co.—Ind.) Chlorine-containing petroleum oils inhibited against copper staining with morpholine.
2,702,792 (American Cyanamid Co.) Aluminum distearate composition and greases prepared therefrom.

Specialties

2,701,213 (Reclaimix, Inc.) Process for reclaiming asphaltic pavement, using an oil of over 40% aromatic content.
2,701,224 (Phillips Petroleum Co.) Nematocidal dicarbothioic acid ester composition and method of applying same.
2,702,256 (Jacques Jean Trachet, Ohain, Belgium) Process of preparing paraffinic anticorrosive strip material by immersing polyethylene film in molten paraffin.
2,702,266 (Standard Oil Co.—Ind.) Briquetting asphalt composition and process of making same.
2,702,756 (Burgess Battery Co.) Electrically conductive wax compositions (containing silver powder.)
2,702,793 (The Texas Co.) Foam-inhibiting and foam-inhibited compositions, using silicones.

Miscellaneous

2,701,175 (The Texas Co.) Method for treating gamma ray detectors.
2,701,375 (Socony-Vacuum Oil Co.) Buoy supported flexible loading hose.
2,701,755 (The Texas Co.) Valve.
2,701,793 (American Cyanamid Co.) Production of silica-alumina gel catalysts.
2,701,832 (Phillips Petroleum Co.) Moisture-sensitive element (colloidal graphite).
2,701,919 (Union Oil Co. of Calif.) Sampling and gasing device for volatile fluids.
2,702,476 (Phillips Petroleum Co.) Apparatus for measuring liquid level.
2,702,479 (Standard Oil Development Co.) Apparatus for introducing liquid samples to mass spectrometers.
2,702,864 (Texaco Development Corp.) Measuring device for tube wall thickness.
2,702,865 (The Texas Co.) Electron multiplier.

EQUIPMENT

Processing, general

2,700,945 (Harold S. Hill) Combined humidifier and preheater of air for combustion apparatus.
2,701,620 (Carlos E. Crawford) Oil, gas and water separator.
2,701,624 (Selas Corp. of America) Gas cleaner.
2,701,642 (Norris Goodwin and G. G. Sanders) Continuous centrifugal separator.
2,701,710 (Air Products, Inc.) Fractionation column.
2,701,753 (Metallgesellschaft Aktiengesellschaft) Extraction of constituents of liquids by means of solvents.
2,702,080 (Texaco Development Corp.) Burner assembly for flow-type gas generators.
2,702,133 (Phillips Petroleum Co.) Table feeder for pebble-heater apparatus.
2,702,184 (Du Pont Co.) Screw mixer and blender.
2,702,236 (Phillips Petroleum Co.) Liquid-liquid contacting device.
2,702,238 (Phillips Petroleum Co.) Apparatus for controlling synthesis reactions.
2,702,269 (Rutgerswerke Aktiengesellschaft) Coking or cracking of oils, pitches, etc.
2,702,594 (Swift and Co.) Apparatus for concentration of charable heat-sensitive liquids.
2,702,696 (Standard Oil Development Co.) Apparatus for operating a countercurrent vapor-liquid processing zone.
2,702,699 (S. P. Kinney Engineers) Gas washer.
2,702,741 (Celanese Corp. of America) Tower reactor.
2,702,742 (Standard Oil Development Co.) Apparatus for contacting solids and vapors.

Are You Moving?

Please let us know as soon as you can so we can change your subscription stencil addressing plate. Be sure to send us

(1) Your *old* address (including company connection)

(2) Your *new* address (including company connection)

(3) The *date* the change becomes effective

PETROLEUM PROCESSING—Subscription Department
330 West 42nd Street—New York 36, N. Y.

BEFORE AFTER

Heat Exchanger bundle before and after cleaning with recommended solvent and improved Oakite Compound 88

How to Cut Equipment Outage through Faster, Easier Cleaning

Impressive cleaning results like those shown above are not unusual when modern Oakite methods are utilized. Whether you're cleaning heat exchangers, fractionating towers, or cat crackers, you'll find you can do a better, more thorough job when you depend on Oakite's cleaning know-how and materials. Here's why:

Oakite refinery cleaners are especially compounded to penetrate even the heaviest petroleum soils and grease residues. Their fast-acting detergency often reduces cleaning time by as much as 75%! This means that out-of-service time is cut sharply—maintenance costs are considerably lessened. Often, equipment that may have been destined for the scrap heap is again restored to operational efficiency. No matter how you look at it, switching to modern Oakite cleaning methods and materials means immediate savings—both in time and money.

Your local Oakite Representative will gladly tell you more about Oakite economy cleaning—call him today. And send for your FREE copy of valuable refinery cleaning guide. No obligation. Write Oakite Products, Inc., 50D Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
PETROLEUM SERVICE DIVISION

Technical Service Representatives in Principal Cities of U. S. and Canada

(To obtain more data on advertised products see page 564)

2,702,742 (Koppers Co.) Apparatus for preheating gaseous and vaporous reagents in powdered fuel gasification.

Catalytic Reactors

RE 23,942 (Houdry Process Corp.) Apparatus for contacting solid materials with fluids.
2,701,184 (Standard Oil Development Co.) Apparatus for carrying out catalytic reactions between hydrocarbon materials.
2,701,185 (Society-Vacuum Oil Co.) Apparatus for regeneration of solid contact material.
2,702,207 (Houdry Process Corp.) Multiple lift for elevating granular solids.
2,702,208 (Sun Oil Co.) Gas lift disengager.
2,701,210 (Standard Oil Development Co.) Hydroforming apparatus.
2,702,434 (Standard Oil Development Co.) Apparatus for countercurrent contacting of fluidized solids with gaseous materials.

Instruments

RE 23,950 (Felix Bloch and James L. Hansen) Means for chemical analysis by nuclear inductions.
2,700,891 (U.S. Navy) Direct reading viscometer.
2,700,900 (L'Air Liquide, Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude) Apparatus for determining the level of a volatile liquid in a vaporizer.
2,700,901 (Edward J. Rickner) Liquid level-measuring apparatus.
2,701,419 (Lee Des Voignes) Underground tank probe.
2,701,468 (American Cyanamid Co.) High-pressure, specific-gravity, constant-level sampling well.
2,701,469 (Radio Corp. of America) Viscometer.
2,701,748 (Panellit, Inc.) Automatic process logging system.
2,701,961 (LKB-Producter Fabriksaktiebolag) Osmometer.
2,701,964 (Pacific Transducer Corp.) Surface thermometer.
2,702,047 (Emil Greiner Co.) Manostat.
2,702,476 (Phillips Petroleum Co.) Apparatus for measuring liquid level.
2,702,479 (Standard Oil Development Co.) Apparatus for introducing liquid samples to mass spectrometers.
2,702,480 (Joseph Q. Hobach) Liquid-sampling apparatus.
2,702,519 (Societe "Le Materiel Electrique S.W.") Liquid circulation indicator.
2,702,864 (Texaco Development Corp.) Measuring device.
2,702,897 (Standard Oil Co.—Ind.) Telemetering wet test meter.

Pumps & Compressors

2,700,876 (L'Air Liquide, Georges Claude Societe) Plant for forcing gas under pressure from the liquefied gas.
2,700,936 (Thompson Products, Inc.) Flexible helix rotor pump.
2,701,092 (The Honorary Advisory Council for Scientific and Industrial Research) Rotary compressor.
2,701,331 (John C. Holst) Pumping apparatus with electromagnetically propelled piston.
2,701,529 (Weil Pump Co.) Submersible sump pump.
2,701,530 (Josef Schellerer) Multistage contrifugal pump.
2,701,532 (William E. Bakewell) Means for minimizing wear of internal-external gear pumps.
2,701,684 (Worthington Corp.) Oil circulating system for rotary fluid compressors.
2,702,004 (British Thomson-Houston Co.) Linear polyphase electromagnetic pump.
2,702,005 (Charles C. Kruse) Pump.
2,702,008 (U.S. Navy) Pumping apparatus.
2,702,147 (Frederick M. Turnbull) Fluid dispensing unit and pump.
2,702,156 (Central Scientific Co.) Diffusion pump.
2,702,509 (Air Equipment) Rotary pump.
2,702,510 (George J. Dourte) Pump.

Valves & Fittings

2,701,116 (Roger Roth) Pressure fluid flow control valve.
2,701,148 (Karl L. Lanninger) Pipe coupling.
2,701,149 (Hans Kreidel and Hans Kreidel, Jr.) Compressed wedge pipe coupling.
2,701,578 (Air Reduction Co.) Precision gas pressure regulator.
2,701,580 (Sullivan Valve and Engineering Co.) High and low-pressure safety cutoff valve.
2,701,581 (Bell and Gossett Co.) Flow control valve.
2,701,704 (Theodore G. Lawrence) Automatic cutoff valve.
2,702,048 (Rain Bird Sprinkler Mfg. Co.) Pressure regulator.
2,702,049 (Taylor-Winfield Corp.) Fluid valve.
2,702,052 (General Controls Co.) Throttling snap-action valve.
2,702,160 (Charles A. Clock) Pressure and bellows-operated release valve.
2,702,178 (Zimmerman and Jansen) Slide valve.
2,702,559 (Albert G. Bodine, Jr.) Sonically actuated valve.
2,702,565 (General Motors Corp.) Screwed plug for closing pipe ends.
2,702,671 (Detroit Controls Corp.) Differential temperature valve with pressure override.
2,702,686 (Ronald Fortune) Diaphragm valve.
2,702,715 (Forrest Andrews) Threaded extensible pipe coupling for insertion between and connection to fixed members of a pipe line.
2,702,717 (R. M. Wade and Co.) Whell supported pipe line.
2,702,723 (Alco Valve Co.) Constant superheat time lag expansion valve.

Miscellaneous

2,701,789 (Upjohn Co.) Fractionating distilling head.
2,702,065 (Imperial Brass Mfg. Co.) Tube bending apparatus.
2,702,066 (William E. Mathes) Pipe bender.
2,702,849 (Crouse-Hinds Co.) Explosion-resisting lighting unit.

How to Obtain Patents

Readers may obtain copies of any U.S. patent from the Patent Office at 25¢ each. Order by patent number direct from The Commissioner of Patents, Washington 25, D.C.

FOR EFFICIENT FILTER OPERATION

Switch to

ANTHRAFILT

Trade Mark Reg. U.S. Pat. Off.

"the modern filter medium"

USED BY MANY LEADING OIL COMPANIES FOR:

- Filtration of Water for Repressure Pumping.
- Filtration of Sanitary and Cooling Water Supplies.
- Filtration of Spent Doctor and Process Wash Waters.
- Boiler Feed Water Supplies.
- Removal of Oily Condensates.
- Prevention of Pollution by Refinery Wastes.

ANTHRAFILT can be used in any filter requiring a filter media. Get the benefit of higher rates, longer runs and lower backwash requirements, along with a better quality of filter effluent.

ANTHRAFILT, being essentially a pure carbon, is not affected by acid or alkaline solutions.

Additional Information, Recommendations and Quotations Furnished on Request By:

PALMER FILTER EQUIPMENT CO

P. O. Box 1696—822 E. 8th St., Erie, Pa.

Representing ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg., Wilkes-Barre, Pa.

YOU CAN STILL GET THESE POPULAR REPRINTS

"REFINERY INSTRUMENTS—WHAT MAKES THEM TICK?"

A series of 8 articles by Cornelius E. Shannahan, instrument engineer with M. W. Kellogg Co., dealing with the four basic refinery instruments (pressure, temperature, flow, level), plus sections on controllers, control valves and pneumatic transmission—40 pages, 8¼ x 11¼, paper bound (1951-2) $1.00

"VAPORIZATION EQUILIBRIUM CONSTANTS AND ACTIVITY COEFFICIENT CHARTS"

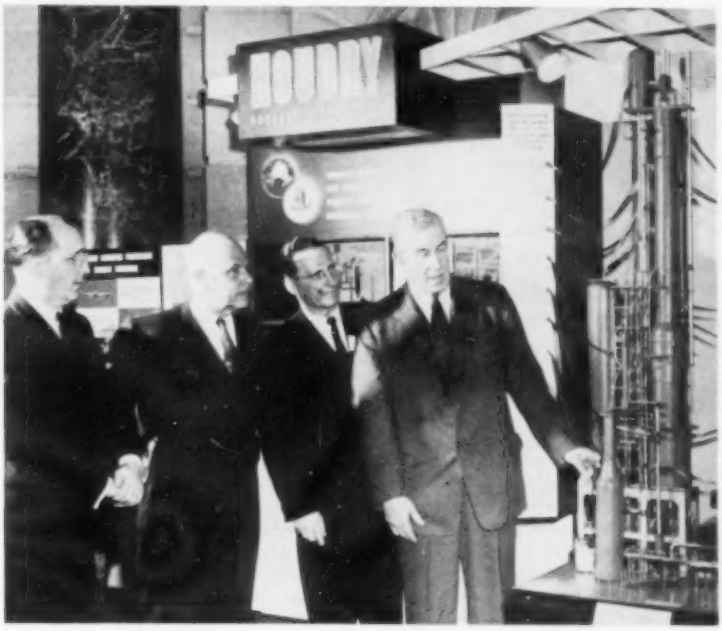
41 working-scale charts (21 equilibrium constant charts for the hydrocarbons from methane to 700°F. boiling point, and 20 activity coefficient charts), plus a description of how to use them—48 pages, 8½ x 11, paper bound (1949) $1.50

ADDRESS READER'S SERVICE DEPARTMENT

PETROLEUM PROCESSING

330 West 42nd Street, New York 36, N. Y.

Note: New York City residents add 3% Sales Tax



U. S. SECRETARY OF COMMERCE SINCLAIR WEEKS, second from left, here is being shown a model of a Houdriflow catalytic cracking unit on display as part of an exhibit of American patents in the Department of Commerce building in Washington. Explanations are being given by U. S. Commissioner of Patents Robert C. Watson right. Houdry representatives are Roy C. Hackley, Jr., vice-president, left, and C. G. Kirkbride, president, next to Mr. Watson.

CCDA Picks New President-Elect

The Commercial Chemical Development Association has elected F. S. Swackhamer vice-president of the association for 1955 and president-elect for 1956. Mr. Swackhamer is manager of the resins and plastics department of Shell Chemical Corp.

R. L. Bateman, director of product development, Carbide and Carbon Chemicals Corp., is completing his term as the organization's vice-president this year and will serve as president for the year beginning July 1, 1955. He succeeds Nolan B. Sommer, plastics and resins div., American Cyanamid Co.

Houdry Contracts with Germans

European license-holders of the Houdriforming process will soon be able to obtain catalyst supplies made on the continent, under terms of an agreement the Houdry Process Corp. has concluded with the Chemische Werke Huels A. G. at Marl, Kreis Recklinghausen, Germany.

The German firm will produce and sell the Houdriforming catalyst to present license-holders and to others who make appropriate licensing arrangements with the Houdry company. The only source of the catalyst at present is the Houdry plant at Paulsboro, N. J.

Penn Instrument and B-M Merge

Penn Industrial Instrument Corp., Philadelphia, has become a division of Burgess-Manning Co. as the result of a corporate merger. Penn's products, including flow meters and other measuring and controlling devices, will continue to be manufactured at the Philadelphia location. William C. Bennett, president, has been elected vice-president and director of Burgess-Manning and will manage the new division.

William Melas, vice-president of Penn, is now a director in Burgess-Manning and will continue in charge of Penn's engineering and development. George D. Keller remains in charge of sales, assisted by William Braun, who recently joined the company.

In other personnel changes in Burgess-Manning, S. G. Paddock, manager of the Dallas div. and general sales manager, has been elected a vice-president of the company. H. A. Dietrich has been promoted to manager of the Libertyville, Ill., div.

NACE Elects New Officers

The National Association of Corrosion Engineers has elected F. L. Whitney, Jr., Monsanto Chemical Co., president for 1955. Vice-president is W. F. Fair, Jr., tar products division of Koppers Co., Westfield, N. J. R. A. Brannon, Humble Pipe Line Co., Houston, was re-elected to a sixth term as treasurer.

Officers were installed during the recent NACE annual conference and exhibition held in Chicago.

Williams Named NCA President

T. C. Williams, executive vice-president of Stone & Webster Engineering Corp., has been elected president of the National Constructors Association. Mr. Williams succeeds John F. O'Connell, vice-president of the Bechtel Corp., the group's president during the past year.

C. D. Haxby, vice-president of the Rust Engineering Co., was elected vice-president of the association, and C. B. Bronson re-elected secretary-treasurer.

Firm Changes Name, Adds Units

The American District Steam Co., Inc., North Tonawanda, N. Y., has changed its name to ADSCO Industries, Inc., and has formed two new operating divisions.

The North Tonawanda plant operation is now known as the American District Steam Division of ADSCO Industries, and the California Steel Products Co. of Richmond, Calif., has become the California Steel Products Division. The latter firm was purchased by American District over a year ago.

American District Steam Division manufactures pipe expansion joints, heat exchangers and processing equipment. The California firm specializes in engineered fabrication of steel and alloy plate, pipe and structural work.

Lukens Studies Clad Steels

The effect of high temperature on clad steels is under study by the Lukens Steel Co., manufacturer of clad steel plates. The research is aimed at filling the gap in published data on the behavior of these materials at prolonged elevated temperatures, as the company believes sufficient informa-

(Advertisement)

CATALYST CONTAMINATION CURED BY REMOVING ENTRAINMENT IN DISTILLATION UNIT

Equipment Costing $15,000

Pays Out In Under A Week

For Large Southwestern Refinery

It was not a difficult problem to trace the cause of mounting catalyst losses to a cat unit feed so poor in color that it was essentially black. Entrainment of liquid from the bottom of the still column could be the only answer.

Here was a situation where a Metex Mist Eliminator would remove the entrainment—but what else might happen? Would this knitted wire mesh separator cause excessive pressure drop? How quickly would it become plugged by coke deposits and make the column inoperable?

Calculations by one engineer showed that the total cost of installing a 25-ft diameter Mist Eliminator, including designing and erecting supports within the still, was approximately $15,000—less than a week's catalyst loss. After considerable study the decision was made, and the Mist Eliminator installed during the next routine turnaround.

When the first run of cat unit feed came from the remodeled crude distillation unit, it was crystal clear and water white. Throughout the normal run no differential pressure across the screen was found.

The problem was solved. Catalyst losses dropped sharply. And the Mist Eliminator has paid for itself in a matter of days.

Have you really analyzed your entrainment costs, and checked the savings a Mist Eliminator could make for you? Perhaps you are losing valuable end products in the exhaust stream. Perhaps you have a nuisance contamination problem. Perhaps the entrainment created in one vessel is causing trouble in a subsequent operation. For entrainment is an inevitable result of most processing and refining operations.

Metex Mist Eliminators perform just one function—and they are doing it in more and more refining vessels every day. They remove liquid entrainment—efficiently and economically—wherever it may occur.

Why not write today for more information on Metex Mist Eliminators. Or better yet, send data on your particular entrainment problem. We'll be glad to have our engineers check this, and send you our recommendations and suggestions. Metal Textile Corporation, Roselle, New Jersey.

tion exists of their physical properties at ambient temperatures.

Most of the research is being carried out at the Franklin Institute, Philadelphia, with the support of the company's own research laboratories in Coatesville, Pa. In the initial phase of the program the properties of stainless-clad steel (18-8 type) are being studied at temperatures up to 1000° F. This particular metal was chosen because of the big differences in the physical properties of its components—stainless and carbon steel. The research will give particular attention to the differences in thermal expansion and yield strengths and their possible effect on fatigue life.

F&P Founds German Affiliate

A German affiliate, Sartorius-Fischer, Gottingen, has been organized by Fischer & Porter Co., Hatboro, Pa., for manufacture and sale of industrial process control instrumentation and chlorinators under the American firm's patents and designs.

New Pipe Firm in California

Herrick-Bradley Engineering, a new firm in the pipe fabrication field, has just completed a plant at Norwalk, Calif. The company specializes in work for the oil, chemical and atomic energy industries.

President is Jim Herrick, at one time a vice-president of Cardwell Manufacturing Co., Wichita, Kan., and more recently a distributor for Caterpillar Tractors in northern California. W. H. Bradley, Rivera, Calif., is vice-president and general manager. He was previously with Fluor Corp. and other major contractors.

B&W, Globe Sales Offices Merge

As a consequence of the recent purchase of Globe Steel Tubes Co. by the Babcock & Wilcox Co. a number of changes have been made in the sales organization of Babcock's Tubular Products Div.

In St. Louis, F. T. Murphy and C. J. Ponsot, who were with the Globe office, now are working with the Tubular Products Div. at its new location in the Continental Building, 3615 Olive St. The St. Louis office has been placed under the general supervision of the division's Chicago district sales manager, Leon B. Wohlgemuth. In addition, J. N. Rogers has joined the St. Louis sales force from the Chicago office of Tubular Products.

The sales office of Globe Steel at Houston has been consolidated with the Tubular Products office there, located at 2134 Welch St. A. M. Johnson, formerly of Globe's Houston staff, has moved into the Tubular Products office, where G. H. Weight is in charge of sales.

The Cleveland offices of the two firms also have been merged, and J. J. Lukens, who handled Globe's sales in the territory, has moved into the sales headquarters of Tubular Products in the National City Bank Building, 629 Euclid Ave. This office will be under the supervision of the Beaver Falls district sales manager, James A. Cook.

The Tubular Products Div.'s office at 615 Griswold St. in Detroit has taken over the operations of the Globe sales force in that city, and F. H. Foglesong will supervise its activities.

Davison Plans Canadian Plant

A wholly owned Canadian subsidiary of the Davison Chemical Co. will be constructed near Montreal to produce synthetic Fluid petroleum cracking catalysts for the Canadian refining industry. Davison Chemical Co. Ltd., the subsidiary, will employ nearly 150 people at the projected plant, and will constitute the first producer of these catalysts in Canada, according to the company. All raw materials for the process will come from Canada.

The plant will be located on a 30-acre tract in Valleyfield, 40 miles southwest of Montreal, and engineering work is being done by Badger Div. of Stone & Webster Engineering Corp.

Personnel Changes

Rockwell Manufacturing Co.—W. D. Willes, formerly general manager of Nordstrom valve plants at Barberton, Ohio, and Oakland, Calif., to product manager of the division, with headquarters at Pittsburgh; Orville W. Barnett, formerly product manager, to manager of Nordstrom distribution and oil field sales.

Atlas Valve Co.—Harry T. Wentworth to general manager, from chief engineer.

The Emil Greiner Co.—Robert E. Bader to executive vice-president.

R. M. Hollingshead Corp.—George F. Sharrard to manager of the technical service div.

Tellepesen Petro-Chem Constructors—Howard K. McLaughlin, from development engineer with Naugatuck Chemical Div. of U. S. Rubber Co., to asst. chief engineer.

(To obtain more data on advertised products see page 564)

Suppliers

Worthington Corp. — Hobart C. Ramsey was elected a board member of the National Industrial Conference Board.

Kaiser Steel Corp. — Richard L. Erlin to manager of engineering sales.

Davison Chemical Co. — I. A. Schwint to the petroleum catalyst dept.

Leader Iron Works, Inc.—C. S. Robison, Jr., to manager of the filtration div., with offices at 919 N. Michigan Ave., Chicago.

American Cyanamid Co.—R. G. Keppler to technical sales representative in Houston for the refinery chemicals dept.

Stauffer Chemical Co. — Charles Loring to eastern district sales manager of the industrial chemicals div.

Swartwout Co.—Robert E. Budde to regional product manager for the midwestern area, with headquarters in Chicago.

ElectroData Corp.—Jack C. Van Paddenburg and Robert Sanekoff to the eastern regional headquarters at 161 E. 42nd St., New York.

Cooper-Bessemer Corp.—Robert F. Lay to general sales manager; Grant C. Woodard to asst. general sales manager.

Key Co.—Bart R. Braznell to sales manager; L. J. (Si) Fundis to asst. sales manager of this manufacturer of special equipment for the oil refining, chemical and power industries.

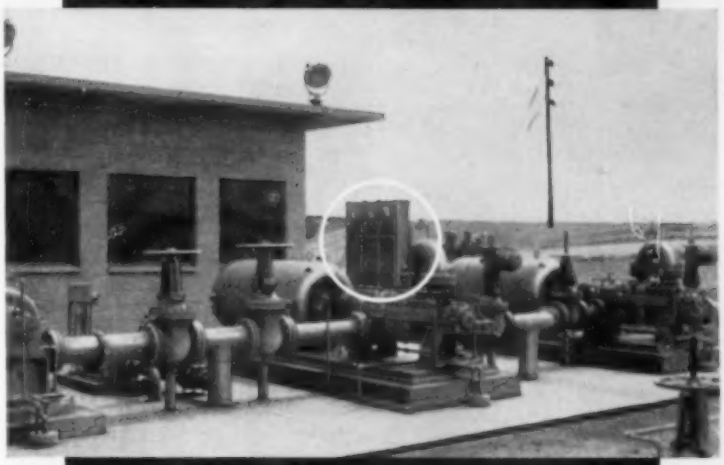
Carbide and Carbon Chemicals Co.—Dr. A. B. Steele to manager and C. P. McClelland to asst. manager of technical service, a newly created group responsible for supplying technical assistance to Carbide's customers.

Arnold O. Beckman, Inc.—S. C. Danforth to sales promotion manager.

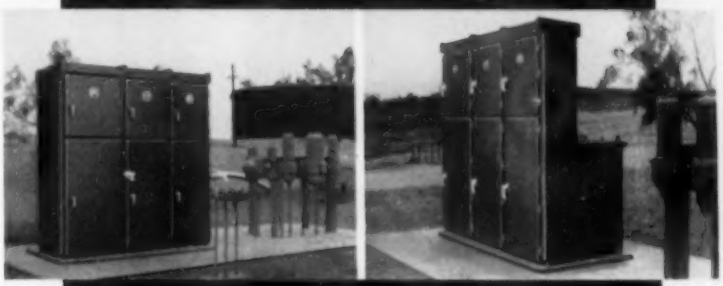
Koppers Co., Inc.—W. F. Munnikhuysen to chairman of the board and Fred C. Foy to president of the company; Robert R. Bench to sales representative in the chemical div.'s new Houston sales office, at 4101 San Jacinto St.

J. F. Pritchard and Co.—W. W. Bodle, manager process and research dept., to manager of the Chicago district office; Paul W. Laughrey to manager of the process and research dept.

EC&M 2200-5000 VOLT



MOTOR STARTERS



Pay off!

with

1. CERTIFIED 50,000 KVA interrupting capacity
2. Oil-immersion for corrosion protection
3. Dependable, low-cost operation

In tank farm, gathering station, and pipeline pumping station applications, EC&M high voltage motor starters have earned a reputation for dependable, low-cost operation.

EC&M starters are virtually trouble-free, oil-immersion keeps working parts well lubricated . . . protects against corrosion. And, being automatic push button type, these starters make it easy for a station attendant to start or stop the motor-driven pumps as required.

In prominent oil centers, EC&M 2200-5000 volt motor starters are recognized for their efficiency and long life.

Investigate them today!

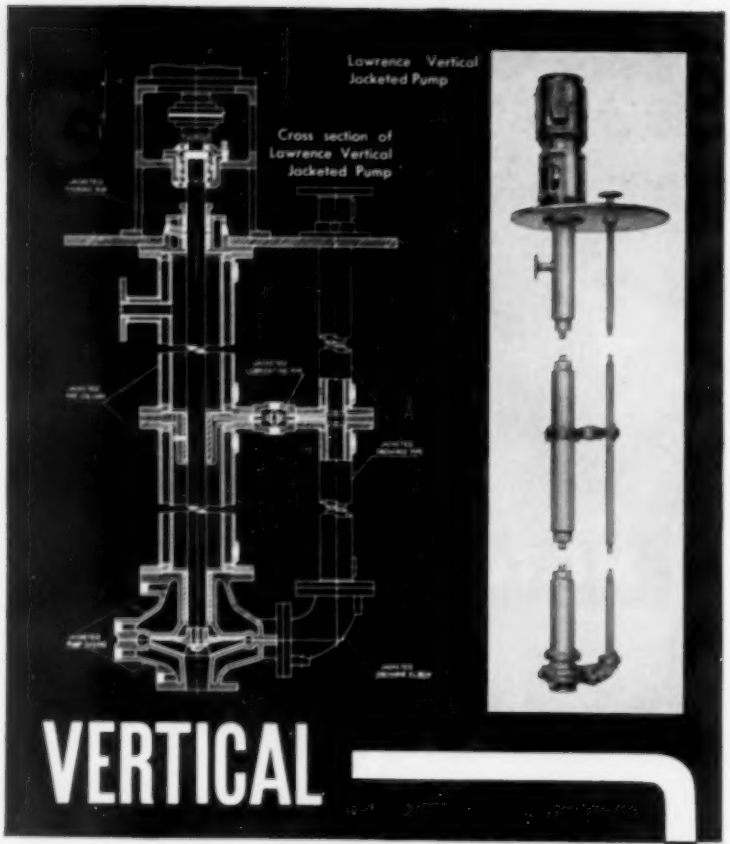
Write for Booklet 1062

THE ELECTRIC CONTROLLER & MFG. CO.

2698 East 79th St. • Cleveland 4, Ohio

6079

(To obtain more data on advertised products see page 564)



VERTICAL jacketed PUMPS

Lawrence vertical jacketed pumps are designed to pump liquids such as sulphur, phthalic anhydride, resins, waxes, etc., which tend to solidify or become viscous at low temperatures. The heating medium can be steam, dowtherm, etc.

The pump is jacketed throughout, i.e. — the pump casing, pipe column, discharge pipe and packing box. All heating spaces are vented and self-draining.

For submerged operation, these pumps are frequently made with only the pipe column, discharge pipe and packing box jacketed; the pump itself, not being jacketed.

If you have to pump liquids which must be maintained above a certain temperature to prevent solidification, write us the pertinent details. No obligation.

Write for Bulletin 203-7.

LAWRENCE PUMPS INC.
361 Market Street, Lawrence, Mass.

Suppliers

Conoflow Corp.—Warren G. Brand, from director of engineering and research to vice-president in charge of engineering and research.

Delta Tank Mfg. Co.—Ross B. Baze, formerly of Black, Sivalls & Bryson, to sales manager of the oil field equipment and special order products div.; Russell A. Gasal to general manager of the Beardstown, Ill., plant, succeeding John T. Nesser, who has been named sales manager of the liquefied petroleum gas equipment div.

Santa Fe Tank & Tower Co.—James G. De Flon to chief engineer of the cooling tower div.

Orbit Valve Co.—Don O. Meeker to the sales staff at Odessa, Texas.

Dow Chemical Co.—R. E. TenHoor to supervisor of the industrial chemicals section, newly formed to provide technical service for a large number of organic and inorganic products.

Ehrhart & Arthur, Inc.—Frank E. Sesler to Oakland, Calif., as manager of San Francisco bay area engineering and construction activities.

M. W. Kellogg Co.—Waldo McKee to sales manager of the fabricated products div.; Wallace G. Axelson, formerly in charge of crude evaluation work with Esso Standard Oil Co., to the contract sales dept.

Expansion, Transition

Robertshaw-Fulton Controls Co. has relocated its Detroit office at 8406 W. McNichols Rd. Company was at 2680 W. Grand Boulevard.

CLASSIFIED

ASSISTANT TO PROCESS SUPERINTENDENT

Man with Chemical Engineering degree or equivalent, to assist Process Superintendent in operation of new independent refinery. Must have several years' operating experience including working knowledge of modern instrumentation and process controls.

Duties will include technical assistance, some operating supervision, scheduling, and coordination of closely integrated units.

Please send complete resume, including salary requirements to:

Great Northern Oil Company
P. O. Box 3596
Saint Paul 1, Minnesota

(To obtain more data on advertised products see page 564)

Petroleum, Petrochemical Processes

Modern Chemical Processes, Vol. 3, by the editors of Industrial and Engineering Chemistry, 1954, 11¼ x 8 in., 280 pages, indexed, stiff cloth cover, illustrated, $5.00, Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.

THE third volume in a series, in which a new volume is to be issued every second year, *Modern Chemical Processes* describes many processes of interest to the petroleum and petrochemical industries.

Volume 3 covers twenty-three recently developed or applied chemical processes such as ammonia at 1000 atmospheres, American Fischer-Tropsch plant, oil black, oil gas manufacture, formaldehyde from methanol, acetophenone, ammonium nitrate, nitric acid in Great Britain, catalytic asphalt, Wulff process acetylene, and others.

Each process is presented in a separate article covering commercial and technical history of the process; the origin of the present installation; description of the plant installation, process and operation; economics of the process concerning raw materials, processing cost breakdowns, plant investment and amortization; personnel; and future prospects.

Illustrations, tables and charts are used generously in conjunction with the written text.

Writing & Graphic Arts For Technical Communication

The Technical Report, edited by B. H. Weil, 1954, 9¼ x 6¼ in., 485 pages, illustrated, indexed, stiff cloth cover, $12.00, Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.

TECHNICAL reporting has come a long way in the past decade, but the quality of the average technical report is lower than its importance warrants, and the data in reports often becomes lost.

Report writers, technical editors, graphic-arts groups, librarians, filing departments, and administrators, as well as others directly concerned with technical communication will be interested in *The Technical Report*. It is a direct outgrowth of ten papers presented in September, 1953, before the Division of Chemical Literature of the American Chemical Society in a "Symposium on the Research Report, Its Functions, Preparation, Distribution, and Use."

These original papers have been rewritten and new material has been added to include the broader aspect of technical reports and to amplify important aspects.

This book presents the latest and best practices for writing, illustrating, editing, duplicating, filing, retrieving, and using technical reports. While meant to be something of a handbook, effort has been made to discuss the "why's" as well as "how to do it".

Mr. Weil, editor of *The Technical Report*, is Manager of Information Services of Ethyl Corporation's Research and Engineering Department in Detroit, Michigan. He was trained as a chemical engineer at the University of Missouri and the University of Wisconsin. For many years he has been a contributor to PETROLEUM PROCESSING, and has written or co-authored books including "Plastic Horizons," "ABC of Chemical Derivatives from Petroleum," and "Synthetic Petroleum from the Synthine Process."

How to Make Profits from New Chemical Products

Successful Commercial Chemical Development edited by H. M. Corley, 1954, 9¼ x 6 in., 374 pages, indexed, stiff cloth cover, $7.75, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y.

IN FORMER times, 25 to 100 years elapsed between the discovery of a product and its general use. Recent trends have changed so that in the chemical industry alone, several thousand new products have been developed and marketed since about 1940.

Prepared under the auspices of the Commercial Chemical Development Association, this book is claimed to be the first and only documentation of the principles governing each step in the selection and development of promising new chemicals.

The book starts with a review of the growth of the chemical industry in the United States, then proceeds to describe each step involved in the evaluation and development of a new chemical. It discusses objectives, offers practical advice on the problems to be overcome, and presents a number of case histories of new products that were successful and unsuccessful.

In addition to the technical steps involved, the book also discusses other phases of commercial development such as advertising, pricing, packaging, labelling, toxicology, safety, and handling of new products.

H. M. Corley, editor of *Successful Chemical Commercial Development*, is Secretary, General New Products Committee with Armour & Co. with whom he has been for 25 years, starting in marketing research.

New Volume Continues Catalysis Discussions

Catalysis, Vol. 2, Fundamental Principles (Part 2), edited by Paul H. Emmett, 1955, 9¼ x 6½ in., 473 pages, indexed, illustrated, stiff cloth cover, $12.00, Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.

THE key position that catalysis occupies in modern industry has spurred efforts to make catalysis more of a science and less of an art.

Catalysis, Vol. 2, continues in the job of summarizing all that is known in the theory and practice of catalysts begun in Vol 1 (see PETROLEUM PROCESSING, April, 1954, page 581).

Fundamental principles and theories of both heterogeneous and homogeneous catalysts are covered in the first two volumes. The first volume included considerable new material concerning catalysts supports and methods of catalyst preparation, and the second volume includes details concerning modern concepts as to the nature of and mode of action of porous solid catalysts.

Also covered in the second volume—edited, as was the first one, by Paul H. Emmett with the aid of eight qualified contributing authors—is information on pore distribution measurement; pore distribution influence on kinetics, temperature coefficient, and specificity of reactions; the nature of catalyst surfaces and material adsorbed on the catalyst; the general theories of heterogeneous and homogeneous catalysis; and factors influencing homogeneous catalytic systems.

It should be noted that attention in these volumes is focused on the catalysts and catalytic reactions, not on engineering or economic aspects.

Future volumes in the series will cover in detail over 18 specific catalytic reaction mechanisms.

Recent Books Briefly Noted

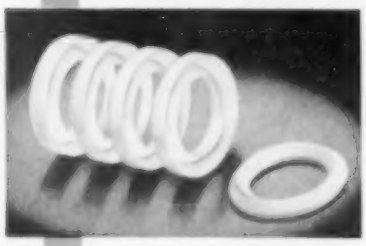
Addenda to Standards of Tubular Exchanger Manufacturers Association, 3rd Ed., 1952, 7 pp., free to present holders—complete standards plus addenda $5.50, Tubular Exchanger Manufacturers Association, Inc., 53 Park Place, New York 7, N.Y.

. . . supersedes or adds material in the 1952 edition concerning tube sheet

MADE OF TEFLON

Chemiseal Packing

- won't contaminate
- won't deteriorate
- won't "freeze" shaft action



V-TYPE PACKING

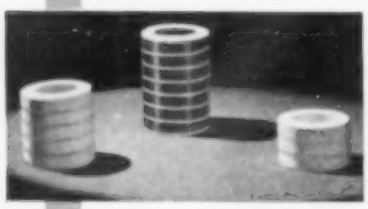
Chemiseal Type 810 TEFLON V-Packing for use in manual, air or motor operated valves. Construction and distinctive tapered V design offers chemically impervious service and greater flexibility and resiliency, providing necessary seal at low gland pressure and reduced torque on valve stem.

CUP AND CONE TYPE PACKING

Chemiseal Type 810-W TEFLON Packing for both hand and mechanically operated valves. Cones deform inwardly to effect a seal at the spindle, while cups expand outwardly against stuffing box wall, making possible a tight seal at low gland pressure.

WEDGE TYPE PACKING

Chemical Type 810-WX Packing offers the unusually low gland load required for valves made of Haveg, Karbate, ceramics, etc. Rings provide space for thermal expansion. Also adaptable for spring loading wherever exceptionally low friction load is required.



PUMP PACKING

Order Chemiseal Types 711-G, (graphite, impregnated) No. 711-M, (impregnated with mica) and No. 711-O (pure TEFLON). For general purpose or non-contaminating pump service throughout the processing industries.

▶ *Write for Catalog Number TP-1053.*

UNITED STATES GASKET COMPANY
CAMDEN 1, NEW JERSEY

USG | **FABRICATORS OF FLUOROCARBONS & OTHER PLASTICS**
Representatives in principal cities throughout the world

design, high pressure heat exchangers, flat covers for multiple-pass channels, and thermal conductivity of hydrocarbon liquids.

Report on the Elevated-Temperature Properties of Selected Super-Strength Alloys, (STP 160), 220 pp., $4.75 ($3.50 to ASTM members), American Society for Testing Materials.

. . . on 13 selected super-strength alloys giving tensile strength summary curves, 0.2% offset yield strength, % elongation and area reduction, available data on stresses for rupture for various times, stresses for creep rates, and brief descriptions of the alloys themselves.

API Accident-Prevention Manual No. 1A: Cleaning Crude-Oil and Unfinished-Products Tanks, revised ed., 1955, 10 x 8½ in., illustrated, $1.00, American Petroleum Institute, 50 W. 50th St., New York 20, N. Y.

. . . discusses and describes hazards which may be encountered in the cleaning of tanks together with minimum precautionary methods, includes recommendations on job planning, selection and care of equipment, inspection procedures, ventilation, testing for vapor or gas, product removal, tank isolation, repairs, alterations and maintenance on tanks.

National Fire Codes, Vols. I through VI, revised to July 30, 1954, 8¾ x 5¾ in., from 420 to 864 pp., indexed, illustrated, stiff cloth cover, $6.00 per volume, National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

. . . codes of interest to petroleum and petrochemical industry intended to provide reasonable safety to life and property, are purely advisory, but widely used for legal and insurance purposes; *Volume I* covers Flammable Liquids and Gases; *Volume II* covers Combustible Solids, Dusts, Chemicals and Explosives; *Volume III* covers Building Construction and Equipment; *Volume IV* covers Extinguishing Equipment; *Volume V* covers Electrical; and *Volume VI* covers Transportation.

API Accident-Prevention Manual No. 13A, prepared by API Committee on Cleaning Mobile Tanks, 1955, 14 pp., illustrated, $1.00, American Petroleum Institute, 50 W. 50th St., New York 20, N. Y.

. . . replaces tentative manual issued five years ago giving information on cleaning—prior to repair—of tank vehicles used to transport flammable liquids with attention to protecting personnel against harmful vapors, and preventing vapor ignition during certain cleaning operations.

Methylamines Chemical Safety Data Sheet SD-87, 1955, 11 x 8½ in., 19 pp., table of contents, no illustrations, light paper cover,

(To obtain more data on advertised products see page 564)

$0.25, Manufacturing Chemists' Association, Inc., 1625 Eye St., N.W., Washington 6, D.C.

. . . covers handling and safe use of methylamines, giving properties, shipping containers, unloading, storage, handling, waste disposal, and health hazards and their control.

Tables of Functions and of Zeros of Functions, National Bureau of Standards Applied Mathematics Series 37, 211 pp., $2.25, Government Printing Office, Washington 25, D.C.

. . . presents ten tables of special functions, such as integrals of the Bessel functions J_0 and Y_0, exponential integrals, Struve functions, values of $x^n/n!$, and eight tables of zeros of functions including zeros of the Legendre and Laguerre polynomials together with the weight factors needed for quadrature, as well as zeros of various kinds of Bessel functions.

Standard Samples and Reference Standards Issued by the National Bureau of Standards, National Bureau of Standards Circular 552, 23 pp., $0.25, Government Printing Office, Washington 25, D.C.

. . . lists over 500 different standard samples of chemicals, ores, ceramics, and metals prepared, certified and distributed by NBS for analytical and research laboratories, including a schedule of weights and fees, directions for ordering, types currently available, and current status of various standards.

Report on the Elevated-Temperature Properties of Selected Super-Strength Alloys, prepared by Ward F. Simmons and Howard C. Cross, Aug. 1954, 11 x 8½ in., 208 pp., table of contents, illustrated, heavy paper cover, $4.75, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . has 116 summary curves on the elevated-temperature strength data for 13 selected super-strength alloys and 206 data sheets showing tensile strength, 0.2 per cent offset yield strength, per cent elongation and reduction of area, stresses for rupture, stresses for creep rates, alloy chemical compositions, recommended heat treatment, and forging and machining.

Deterioration of Materials edited by Glenn A. Greathouse and Carl J. Wessel, 1954, 9¼ x 6½ in., 835 pp., 255 illustrations, indexed, stiff cloth cover, $12.00, Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

. . . compiled by 24 specialists for the Prevention of Deterioration Center, National Academy of Sciences—National Research Council, the book analyzes deterioration problems and preservation techniques with specific applications for protection of wood, metals, paper, textiles, leather, plastics, rubber, paint, etc., affected by climatic, chemical, physical and biological agents.

HIGH QUALITY
ANHYDROUS
Aluminum Chloride
PRODUCED IN TWO GRADES
RESUBLIMED & SUBLIMED

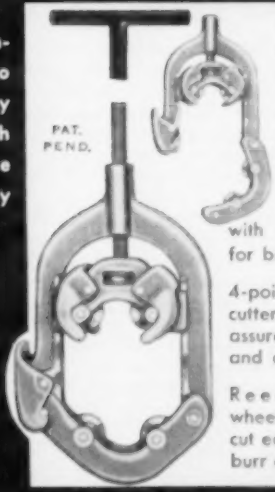
THE PUREST COMMERCIAL MATERIAL AVAILABLE

ANY PARTICLE SIZE OBTAINABLE
OUR STANDARD SIZES
POWDER | -20 MESH | GRANULAR | 4+20 MESH | LUMP | 1+4 MESH

INFORMATION CONCERNING THE PREPARATION of AQUEOUS OR ALCOHOLIC SOLUTIONS OF $AlCl_3$ OBTAINABLE BY WRITING
OHIO-APEX DIVISION
FOOD MACHINERY & CHEMICAL CORPORATION – NITRO, W. VA.
OHIO APEX fmc

IF YOU CUT LARGE DIAMETER PIPE...
YOU NEED THESE
New REED HINGED 4-WHEEL PIPE CUTTERS
Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

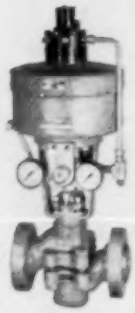
Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

REED MANUFACTURING COMPANY
ERIE, PENNSYLVANIA • U. S. A.

(To obtain more data on advertised products see page 564)

CONOFLOW *Cylinder Conomotors*
now make possible a *complete selection* of
FINAL CONTROL ELEMENTS



Conoflow Series LB Control Valve

CONVENTIONAL—Control Valve

One of the most conventional methods of controliing practically any variable is to use a control valve to regulate the fluid stream on the discharge side of a pump or similar prime mover. This is, of course, a simple and obvious approach, but frequently poses serious problems especially when handling extremely viscous materials, abrasive materials, corrosive fluids, etc. One of the proved and accepted methods of hurdling these perplexing obstacles is to control at the source by positioning .....

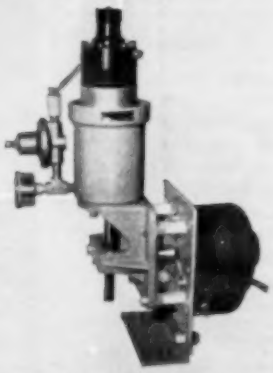
Cylinder Conomotor actuating variable speed drive (Link Belt)

.....THE PRIME MOVER—*mechanically*

In this manner the prime mover is actuated directly by the control instrument—eliminating the necessity of breaking into the line downstream to install a control valve. A most common method of accomplishing this is to control the pump speed by means of a mechanical variable speed transmission. Cylinder Conomotors are available as original equipment on a wide variety of drive units similar to the one illustrated here, including U. S. Electrical Motors, Sterling Electric Motors, Graham Transmissions, Reeves Pulley, etc. Many pumps have been adapted for direct control by using Cylinder Conomotors to automatically adjust pump stroke as in the Lapp Pulsafeeder and Milton Roy pumps. In some cases it is more practical to control at the source through electrical means by modulating .....

.....THE PRIME MOVER—*electrically*

Conoflow EB Current Controllers operating from a 3-15 or other standard range pneumatic controller are available in over 200 combinations of electrical components for controlling voltage, current, inductance, capacitance, resistance or other electrical values. A common approach to the regulation of fluid flow in this manner is to position the rheostat in the motor field or the armature circuit as a direct function of signal pressure, thereby regulating the speed of the D.C. shunt-wound motor driving the pump. On many applications, variable speed transmissions and electric motors can be controlled from zero to full capacity offering a resultant control range that cannot be matched by conventional control valves. In installations involving large capacity equipment this can prove extremely important since it eliminates the needless operation of large centrifugal pumps running at constant speed wasting power by discharging against a stalled or greatly restricted head.



Conoflow EB Current Controller positioning rheostat

For additional information on Conoflow Cylinder Operators write for Bulletin B-50-2.

Cono Controls

CONOFLOW CORPORATION

FOREMOST MANUFACTURERS OF FINAL CONTROL ELEMENTS

2100 ARCH STREET, PHILADELPHIA 3, PA.

NGAA Meeting to Feature Six Forums

ABSORPTION, liquefied petroleum gas, and petrochemicals figure in the program of the Natural Gasoline Association of America's annual convention April 13 to 15. These subjects will be taken up in a series of forums which will also include the topics of corrosion, equilibrium constants, and economics. The convention will be held at the Baker and Adolphus Hotels in Dallas, Texas.

Wednesday, April 13, will be devoted to meetings of committees, the board of directors and other groups.

A forum on absorption will lead off the technical program at the Baker Hotel on Thursday, April 14. To be heard from at that time are:

Dr. Brymer Williams, University of Michigan, speaking on "A Report on Tray Efficiency Studies."

J. B. Taylor, Signal Oil & Gas Co., "Unique Distillation at the Tioga Plant."

E. W. Kilgren, Stanolind Oil & Gas Co., "Relative Efficiency of 20, 30, and 40 Tray Units."

A second forum scheduled for that morning, on LPG, will feature the following topics:

"Advances in LPG Carburetion," by Don Welch, Warren Petroleum Corp.

"Present Status of LPG Storage, Surface and Underground," Charles Guy, Texas Natural Gasoline Corp.

"Blending Butane in Motor Fuel," speaker to be announced.

A corrosion forum is to be held on the same morning at the Adolphus Hotel. Three papers are scheduled to be read but had not been announced by press-time.

The Thursday afternoon program will consist of a general session at the Baker Hotel. The subject will be the National Council for Liquefied Petroleum Gas Promotion. Speakers addressing themselves to different phases of the council's work will be James E. Pew, Sun Oil Co., president of the council; Niel Gilliatt, McCann-Erickson Advertising Agency, and Robert Borden, director of the council.

The general session will also include an address by Dr. Arthur Secord, Brooklyn College, titled "Painting Haystacks," and concerning employee relations.

The program at the Baker Hotel on Friday, April 15, will offer two forums, one on equilibrium constants, the other on economics. The first will present these topics:

"A New Tool for Industry," by Dr. Elliott Organick, Union Producing Co., and chairman of the association's equilibrium ratio committee.

"Research for Equilibrium Constants," by Dr. C. L. De Priester, California Research Corp.

"The Need for Partial Molal Enthalpies," by Karl Hachmuth, Phillips Petroleum Co.

"K-Values for Non-Hydrocarbons," by Robert Jacoby, Stanolind Oil and Gas Co.

Papers to be heard at the economics forum are as follows:

"Vest Pocket Natural Gasoline Plants," R. B. McLaughlin, Northern Natural Gas Co.

"Future of Cycling Gasoline," speaker to be announced.

"Economics of Transporting Natural Gasoline in Crude Lines," by George T. Tennison, Shell Oil Co.

At the same time, there will be a petrochemicals forum held at the Adolphus Hotel. Papers to be heard are:

"The Natural Gasoline Producer's Stake in Chemical Manufacturing," by Lucien Crockett, Gulf Oil Corp.

"The Development of Synthetic Rubber in the United States," by William I. Burt, Goodrich Rubber Co.

"Petrochemicals in Agriculture," by Dr. E. D. Crittenden, Allied Chemical and Dye Co.

The annual presidents' luncheon will be held at noon, and the afternoon program, at the Baker Hotel, will be a general session. Subjects and speakers are to be:

"F.P.C. Regulations," by John F. Merriam, Northern Natural Gas Co.

"Communist Infiltration in the U.S.," Charles Reno, attorney.

A speaker from the Department of National Defense, as yet unannounced.

Fluid Flow Main Topic For Chemical Engineers

"Fluid Flow in Practice" will be the theme of the third annual "Experience in Industry" meeting sponsored jointly by the Philadelphia-Wilmington Section of the American Institute of Chemical Engineers and the University of Pennsylvania's school of chemical engineering. It will be held Tuesday, April 26, at the University of Pennsylvania Museum, 34th and Spruce Streets, Philadelphia.

The technical program will consist of the following papers:

"Review of Basic Relationships," by Prof. W. E. Ranz, Pennsylvania State College.

"Planning New Piping Systems," by S. A. Gertz, M. W. Kellogg Co.

"Which Valve and Why," by Otto Kneisel, Hammel-Dahl Co.

"Which Flow Meter and Why," by Louis Gess, Brown Instrument Div., Minneapolis-Honeywell Regulator Co.

"Operation and Maintenance of Fluid Flow Equipment," by N. H. Walton, Atlantic Refining Co.

"Research in Fluid Flow," by Prof. A. S. Foust, Lehigh University.

Rocky Mountain Refiners To Meet Apr. 28-29

The refining committee of the Rocky Mountain Oil and Gas Association will hold its annual meeting April 28 and 29 at the Cosmopolitan Hotel, Denver, Colo.

As in previous years, the meeting will include sessions on industrial relations, refining processes, and safety.

NPA to Hear Speakers On Diesel Fuel, Lube Problems

A symposium on railroad diesel fuel and lubrication problems will occupy a prominent place on the program of the National Petroleum Association's Cleveland meeting, April 13 to 15. The event will be the NPA's 52nd semiannual meeting and is to be held at the Hotel Cleveland.

The symposium will take place Friday morning, April 15 and participants will be:

R. J. Griffith, sales engineering division, Esso Standard Oil Co.

R. W. Seniff, manager-research, Baltimore & Ohio Railroad.

P. V. Garin, engineer of research and mechanical standards, Southern Pacific Co.

Harold R. Sennstrom, American Locomotive Co.

R. J. Finney, Cities Service Research and Development Co.

H. V. Nutt, U.S. Naval Engineering Experiment Station.

ASLE Meeting to Feature Lubrication Short Course

A special short course in lubrication will be part of the American Society of Lubrication Engineers' 10th annual meeting and lubrication exhibit, scheduled for April 13 to 15 at Chicago's Hotel Sherman. Altogether there will be 16 technical sessions, the five-session short course, three panel discus-

You get full 180° visibility . . . so you can read the liquid level from any point from which you can see the gage . . . with the New Convex Scale now available on Jerguson Truscale Remote Reading Gages. Scale markings are directly on the convex face and the indicator goes clear around the convex surface. You can stand at one end of the control room and instantly check your whole line up of Truscale Gages.

Jerguson Truscales give you instant remote readings of liquid levels of waste heat boilers, tanks, etc. . . . with the amazing accuracy of ½ of 1% of scale reading. And with the New Convex Scale you make these readings from any angle . . . accurately, without distortion. Truscales also available with lights, horns and Truscale Repeaters.

Write today for complete data on Truscale Gages with the New Convex Scale.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.

Offices in Major Cities
Bailey Meters & Controls, Ltd., London, Eng.
Controle Bailey, Paris, France

sions, a symposium, and a plant tour.

Panels will be on these topics: "Controls for Extending the Useful Life of Coolants While in Use;" "Industrial Dermatitis," which is to be led by some noted dermatologists; and "Organization of a Plant Lubrication Program." The symposium will discuss "Plant Safety as Related to Lubrication" and will take up non-flammable hydraulic fluids, the advantages of centralized lubrication, proper dispensing equipment, and safeguards against injury and fire.

Some papers of interest to petroleum processing men tentatively scheduled for the 16 technical sessions are:

"Corrosion Inhibited Greases," by G. H. Link; "Effect of Additives in Mineral Oil on Rate of Fretting Wear," by D. Godfrey; "Effect of Pressure and Molecular Weight Upon the Viscosity of Polybutens," by L. B. Sargent.

"Evaluation of Lubricating Grease Compatibility," by A. L. McClellan and S. R. Calish; "Factors Influencing Friction and Wear with Solid Lubricants," by M. B. Peterson and R. L. Johnson; "Heat Treating and Quenching Oils," by R. Weir.

"Nature and Performance of Some Inorganic Base Greases," by W. H. Peterson and A. Bondi; "Nonflammable Hydraulic Fluids," (1) by W. H. Millett, (2) by C. F. Schmidt.

"Progress Report on Silicone Lubricants," by H. F. Lamoreaux; "X-Ray Methods Applied by Automotive and Petroleum Research," by F. W. Lamb.

Oil Man's Calendar

APRIL

National Petroleum Assn., semiannual meeting, Cleveland Hotel, Cleveland, Apr. 13-15.

Natural Gasoline Assn. of America, annual convention, Baker and Adolphus Hotels, Dallas, Texas, Apr. 13-15.

American Society of Lubrication Engineers, annual meeting, Hotel Sherman, Chicago, Apr. 13-15.

Third National Air Pollution Symposium, sponsored by the Stanford Research Institute and others, Huntington-Sheraton Hotel, Pasadena, Calif., Apr. 18-19.

American Society of Mechanical Engineers, spring meeting, Lord Baltimore Hotel, Baltimore, Apr. 18-20.

Petroleum Industry Electrical Assn., annual conference, Shamrock Hotel, Houston, Apr. 20-22.

American Society of Mechanical Engineers, Region VIII Engineering Conference, Rice Hotel, Houston, Apr. 24-27.

Independent Petroleum Assn. of America, midyear meeting, Plaza Hotel, San Antonio, Apr. 25-28.

"Experience in Industry", sponsored by Philadelphia-Wilmington Section of American Institute of Chemical Engineers and the University of Pennsylvania, at the U. of Pennsylvania Museum, 34th and Spruce Sts., Philadelphia, Apr. 26.

Rocky Mountain Oil and Gas Assn., annual meeting of the refining committee, Cosmopolitan Hotel, Apr. 28-29.

MAY

American Institute of Chemical Engineers, national meeting, Shamrock Hotel, Houston, May 1-4.

Liquefied Petroleum Gas Assn., annual meeting, Conrad Hilton Hotel, Chicago, May 1-4.

American Petroleum Institute, meetings of evaporation loss committee and subcommittee, Edgewater Beach Hotel, Chicago, May 2-4.

International Oil Exposition, Houston, Texas, May 3-8.

10th Purdue Industrial Waste Conference, Purdue University, Lafayette, Ind., May 9-11.

American Petroleum Institute, Division of Refining midyear meeting, Jefferson Hotel, St. Louis, May 9-12.

10th Annual Symposium on Applied Spectroscopy, Hotel New Yorker, New York, May 12-13.

6th Automation Symposium, Michigan State College School of Engineering, East Lansing, Mich., May 12-13.

6th Latin American Congress of Chemistry, Caracas, Venezuela, May 12-19.

ACHEMA XI Chemical Engineering Exposition and Congress, Frankfurt am Main, May 14-22.

Western Petroleum Refiners Assn., technical-industrial relations meeting, Settles Hotel, Big Spring, Texas, May 26-27.

Chemical Institute of Canada, annual conference, Quebec City, Que., May 30-June 1.

Third Basic Materials Exposition, Convention Hall, Philadelphia, May 31-June 1.

JUNE

Canadian Gas Assn., annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., June 5-9.

Fourth World Petroleum Congress, Rome, Italy, June 6-15.

Pennsylvania Grade Crude Oil Assn., annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., June 9-10.

Society of Automotive Engineers, Golden anniversary summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 12-17.

16th Iowa Management Course, University of Iowa, Iowa City, June 13-25.

American Society of Mechanical Engineers, semiannual meeting, Statler Hotel, Boston, June 20-23.

American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 26-July 1.

SEPTEMBER

National Petroleum Assn., annual meeting, Traymore Hotel, Atlantic City, Sept. 14-16.

American Institute of Chemical Engineers, Lake Placid Club, Lake Placid, N. Y., Sept. 25-28.

Petroleum Industry Conference, sponsored by the American Institute of Electrical Engineers, Houston, Sept. 27-29.

OCTOBER

American Institute of Mechanical Engineers, Petroleum Branch, fall meeting, Roosevelt Hotel, New Orleans, Oct. 2-5.

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

ADDITIVE, fuel oil, diesel, technical information; DuPont Co. See adv't. p. 548B.

ADDITIVES, lube oil, booklet describes two types in detail; DuPont Co. See adv't. pp. 456A-456B.

ANALYZER for light hydrocarbons, "Fracton," booklet 82; The Burrell Corp. See adv't. p. 455.

ALLOYS, corrosion resistant, samples available; Haynes-Stellite Co. See adv't. p. 473.

CATALYST, synthetic, descriptive folder; Davison Chemical Co. See adv't. p. 577.

CATALYTIC CRACKING, brochure describes "Houdriflow;" Houdry Process Corp. See adv't. p. 460A.

CLEANING COMPOUNDS, for various refinery applications, booklet; Oakite Products, Inc. See adv't. p. 551.

CONDUIT, aluminum, rigid, booklet; Aluminum Co. of America. See adv't. p. 574.

CONTROLS SIZING MANUAL, covers liquid, steam and gas applications; Black, Sivalls & Bryson, Inc. See adv't. p. 450.

COOLING UNITS, air type, bulletin; Hudson Engineering Corp. See adv't. pp. 476A-476B.

DRYING EQUIPMENT, for gas, air and organic liquid, booklet; Pittsburgh Lectrodryer Corp. See adv't. p. 468.

FITTINGS, stainless steel, screw-end and welding types, bulletin S-3-55; Watson-Stillman Fittings Div. See adv't. p. 568.

FITTINGS, tube and hose, four catalogs available; Parker Appliance Co. See adv't. p. 521.

FLOATING ROOFS, double pontoon, manual WP-14; Gen'l. American Trans. Corp. See adv't. p. 442.

FLOW MEASUREMENT, of small quantities with varying viscosity, bulletin; Taylor Instrument Cos. See adv't. p. 587.

GAS TREATING CHEMICALS, to remove H_2S and H_2O, samples; Nitrogen Division. See adv't. p. 544.

HEAT EXCHANGERS, evaporative cooling type, bulletins 120 and 124; Niagara Blower Co. See adv't. p. 570.

INSULATION, industrial, magnesia, catalog; Philip Carey Mfg. Co. See adv't. p. 486.

INSULATION, non-absorbing, for pipes and tanks, booklets; Pittsburgh Corning Corp. See adv't. p. 569.

JACKETING, aluminum, for insulated lines, engineering data and sample; Childers Mfg. Co. See adv't. p. 463.

LIQUID DENSITY, measurement and control, bulletin W-3; Precision Thermometer and Inst. Co. See adv't. p. 584.

LIQUID LEVEL GAGES, remote reading, data on request; Jerguson Gage & Valve Co. See adv't. p. 562.

MASS SPECTROMETER, new brochure CEC 1800C-X10; Consolidated Engineering Corp. See adv't. p. 572.

MECHANICAL SEAL, for pumps, bulletin 427; Durametallic Corp. See adv't. p. 548.

MIXERS, side and top entering, new booklet and catalogs available; Mixing Equipment Co. See adv't. p. 494.

MOTOR STARTERS, high voltage, booklet 1062; Electric Controller & Mfg. Co. See adv't. p. 555.

MOTORS, for final control elements, bulletin B-50-2; Conoflow Corp. See adv't. p. 560.

PAINT, aluminum, two booklets available; Aluminum Co. of America. See adv't. p. 537.

PIPE CUTTERS, four sizes cover wide range, literature; Reed Mfg. Co. See adv't. p. 559.

PROCESS EQUIPMENT, design and fabrication, booklet; Newport News Shipbuilding & Drydock Co. See adv't. p. 460.

PUMPS, for liquids, gases and slurries, catalog; Sigmamotor, Inc. See adv't. p. 592.

PUMPS, air actuated, for meterin, small volume flows, bulletin UP-55; Hills-McCanna Co. See adv't. p. 588.

PUMPS, single stage, centrifugal, bulletin 121; Pacific Pumps, Inc. See adv't. p. 454.

PUMPS, vertical, jacketed, bulletin 203-7; Lawrence Pumps, Inc. See adv't. p. 556.

REFINERY DESIGN and construction, booklet; Kuljian Corp. See adv't. p. 578.

REFORMING, catalytic, brochure, Atlantic Refining Co. See adv't. p. 478.

STAINLESS STEEL, for refinery applications, booklet describes properties; U. S. Steel Corp. See adv't. p. 470.

SWING JOINTS, ball bearing, many types and sizes, catalog 400; Barco Mfg. Co. See adv't. p. 590.

TANK HEATERS, vertical mounting, bulletin 541; Brown Fintube Co. See adv't. p. 476.

TANK GAUGE, electronic, brochure, Gilbert & Barker Mfg. Co. See adv't. p. 526.

TUBES, condenser, many types from many metals, catalog and booklet; Wolverine Tube. See adv't. p. 492A-492B.

TUBES, heat exchanger, aluminum, new booklet; Aluminum Co. of America. See adv't. p. 479.

TUBING, condenser and heat exchanger, welded, bulletin TB-329A; Babcock & Wilcox Co. See adv't. p. 466.

TURBINES, vertical and horizontal, catalog 500; Dean Hill Pump Co See adv't. p. 462.

VALVES, control, motor driven, for fluids, catalog 1500B; Annin Co. See adv't. p. 548.

VALVES, lubricated plug, reference book 39-5; Homestead Valve Mfg. Co. See adv't. p. 586.

VALVES, wedge gate, iron body, catalog; Crane Co. See adv't. p. 575.

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

(A-1) Airetool Mfg. Co. 540
(A-2) Air Preheater Corp. 543
(A-3) Alamask Div., Rhodia, Inc. 584
(A-4) Aluminum Co. of America, Electrical Prods Div. 574
(A-5) Aluminum Co. of America, Pigments Div. 537
(A-6) Aluminum Co. of America, Process Equip. Div. 479
(A-7) American Cyanamid Co., Refinery Chemicals Dept. 484
(A-8) Anaconda Copper Mining Co. .. 571
(A-9) Annin Co. 548
(B-1) Anthracite Equipment Corp. 552
(B-2) Armstrong Cork Co., Inc. 548A
(B-3) Atlantic Refining Co. 478
(B-4) Babcock & Wilcox Co., Tubular Products Div. 466
(B-5) Baker & Adamson Chemicals, Allied Chem. & Dye Corp. ..Cover 3
(B-6) Baldwin-Hill Co. 582
(B-7) Barco Mfg Co. 590
(B-8) Barrett Mfg. Co. 582
(B-9) Bett. W. H. & L. D. 477
(C-1) Bigelow-Liptak Corp. 591
(C-2) Bingham Pump Co. 585
(C-3) Black, Sivalls & Bryson, Inc. 450
(C-4) Brookfield Engr. Labs., Inc. 542
(C-5) Brown Fintube Co. 476
(C-6) Burrell Corp. 455
(C-7) Carey Mfg. Co., Philip 486
(C-8) Chicago Bridge & Iron Co. 460B
(C-9) Childers Mfg. Co. 463
(D-1) Conoflow Corp. 560
(D-2) Consolidated Engr. Corp. 572
(D-3) Cooper-Bessemer Corp. 469
(D-4) Crane Co. 575
(D-5) Davison Chemical Co., Div. W. R. Grace & Co. 577
(D-6) Dean Hill Pump Co. 462
(D-7) Dempster Brothers, Inc. 480-481
(D-8) Dow Chemical Co. 493
(D-9) Du Pont de Nemours & Co., Inc. 456A-456B
(E-1) DuPont de Nemours & Co., Inc. .. 548B
(E-2) Dvrametallic Corp. 568
(E-3) Electric Auto-Lite Co. 592
(E-4) Electric Controller & Mfg. Co. .. 555
(E-5) Enjay Co. 538
Ethyl Corp. 522-523
(E-6) Fluor Corp., Ltd. 489
(E-7) Foster Wheeler Corp. 467
(E-8) Gen'l. American Trans. Corp., Plate & Welding Div. 442
(E-9) Gen'l. American Trans. Corp., Terminals Div. 446
(F-1) Gen'l. Refractories Co. 541
(F-2) Gilbert & Barker Mfg. Co. 526
(F-3) Harshaw Chemical Co. 583
(F-4) Hercules Powder Co. 579
(F-5) Hills-McCanna Co. 588
(F-6) Homestead Valve Mfg. Co. 586
(F-7) Houdry Process Corp. 460A
(F-8) Hudson Engineering Corp. ..476A-476B
(F-9) Jergueon Gage & Valve Co. 562
(G-1) Kellogg Co., The M. W., Contract Sales Div. 490-491
(G-2) Koch Engineering Co. 593
(G-3) Kullian Corp. 578
(G-4) Lawrence Pumps, Inc. 556
(G-5) Lukens Steel Co. 573
(G-6) Lummus Co. 449
(G-7) McKee Co., Arthur G. 472
(G-8) Metal Textile Corp. 554
(G-9) Midvale Co. 453
(H-1) Mixing Equipment Co. 494
(H-2) National Aluminate Corp. 475
(H-3) National Lead Co. 589
(H-4) Natural Gasoline Supply Men's Ass'n. 485
(H-5) Newport News Shipbuilding & Drydock Co. 460
(H-6) Niagara Blower Co. 570
(H-7) Nitrogen Div., Allied Chem. & Dye Corp. 544
(H-8) Nordstrom Valve Div., Rockwell Mfg. Co. 482-483
(H-9) Norton Co. 488
(I-1) Oakite Products Co. 551
(I-2) Ohio Apex Div. 559
(I-3) Oil Well Supply Co. 441
(I-4) Olin Mathieson Chemical Corp. .. 461
(I-5) Orbit Valve Co. 474
(I-6) Oronite Chemical Co. 456
(I-7) Pacific Pumps, Inc. 454
(I-8) Parker Appliance Co. 521
(I-9) Petro-Chem Development Co. 524
(J-1) Phillips Petroleum Co. 547
(J-2) Pittsburgh Corning Corp. 569
(J-3) Pittsburgh Lectrodryer Corp. 468
(J-4) Powell Co., William 581
(J-5) Precision Thermometer & Inst. Co. 584
(J-6) Proportioneers, Inc., Div. B-I-F Industries. .....Cover 2
(J-7) Reed Mfg. Co 559
(J-8) Refinery Engineering Co. 492
(J-9) Ridge Tool Co. 580
(K-1) Santa Fe Tank & Tower Co. Cover 4
(K-2) Sigmamotor, Inc. 592
(K-3) Struthers Wells Corp. 487
(K-4) Taylor Instrument Cos. 587
(K-5) Tretolite 444
(K-6) Union Carbide & Carbon, Haynes Stellite Co. 473
(K-7) U. S. Gasket Co. 558
(K-8) U. S. Steel Corp. 470
(K-9) Universal Oil Products Co. 464-465
(L-1) Wachs Co., E. H. 542
(L-2) Wallace & Tiernan Products, Inc .. 576
(L-3) Watson-Stillman Fittings Div., H. K. Porter Co. 568
(L-4) Wolverine Tube, Div. Calumet & Hecla, Inc. 492A-492B
(L-5) Zink Co., John 471

Classified Advertising

H. E. Hilty, Mgr.

Employment 556

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products, or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

•

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

SAVE TIME • SAVE EFFORT • KEEP INFORMED

USE THIS CARD . . .

to secure information on products and services advertised in *Petroleum Processing* or reviewed in its *"What's New"* section.

FOR ADVERTISED PRODUCT INFORMATION:
Check the Advertiser's Index for advertisement's code letter. Then circle the corresponding code letter on the card below.

FOR "WHAT'S NEW" PRODUCT INFORMATION:
Circle the code number on the card below which corresponds to the number listed at the end of that specific "What's New" item.

THEN:
Fill in your name, position, company and mailing address. Mail the card . . . no postage is required.

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER JULY 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80

ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

4/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER JULY 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80

ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

4/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

FOR MORE INFORMATION...

about products and services advertised in this issue of Petroleum Processing or reviewed in its "What's New" section, use the postage-free cards provided below.
(See other side for complete instructions.)

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary If Mailed In the United States

4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary If Mailed In the United States

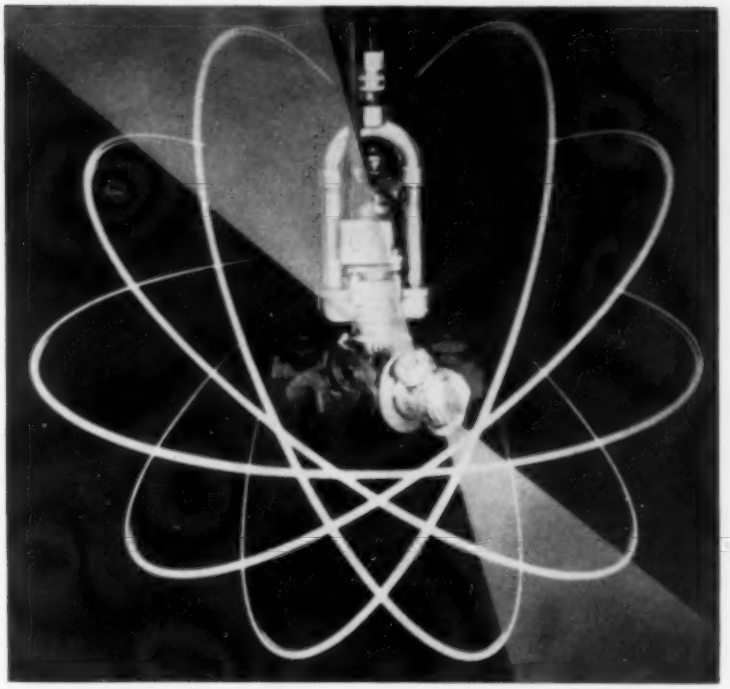
4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

WHAT'S NEW...



Tank Cleaner Has Rotary Motion

A pneumatically rotated cleaning jet which delivers two powerful streams of hot or cold water, with or without detergents, can clean the entire inside surface of any shaped tank. One man can handle the tank cleaning operation without assistance. The "Rotor Jet" is lowered through the tank access by means of its supply hose, and its operation is controlled from the outside so that workmen do not have to enter the tank. The three-dimensional movement of the jet assures complete coverage of the inside of the tank. Cleaning speeds are adjustable with high speeds for light cleaning or rinse, and slow speeds for heavy cleaning. The two jets are powered by a venturi-injector which provides high velocity streams to give a scrubbing action rather than a cascading action. The jet head is rotated pneumatically. The "Rotor Jet" is available in three models for capacities from 600 to 6000 gpm. Sellers Injector Corp., 1603K Hamilton Street, Philadelphia 30, Pa.

Circle No. **1** *on Reply Card*

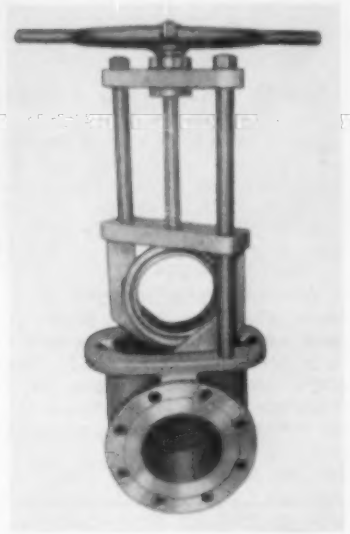
For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.

Electronic Supervisor Controls Forty Remote Plant Operations

. . . for preset programs, automatically switching on or off each operation on its own time schedule. The "Central Control System" will switch lights on or off, start and stop motors, open and close valves, or start and stop production line machinery in automated plants. Operation is by carrier current signals operating over existing electrical circuits. Panel indicator lights give a quick means of visually checking the status of each operation. Possible applications include the control of plant heating systems, ventilators, lights, pumps, and night time protective systems and lights. If the need arises to depart from the preset schedule, manual operation is possible. The carrier current system does not interfere with regular electrical functions when superimposed on commercial 60-cycle power and lighting circuits. Basic components are the central operations panel, transmitter, and coded relays. The system can be expanded by the installation of additional circuits, pluggable relays, and pluggable programming units. International Business Machines Corp., 590 Madison Ave., New York 22, N. Y.

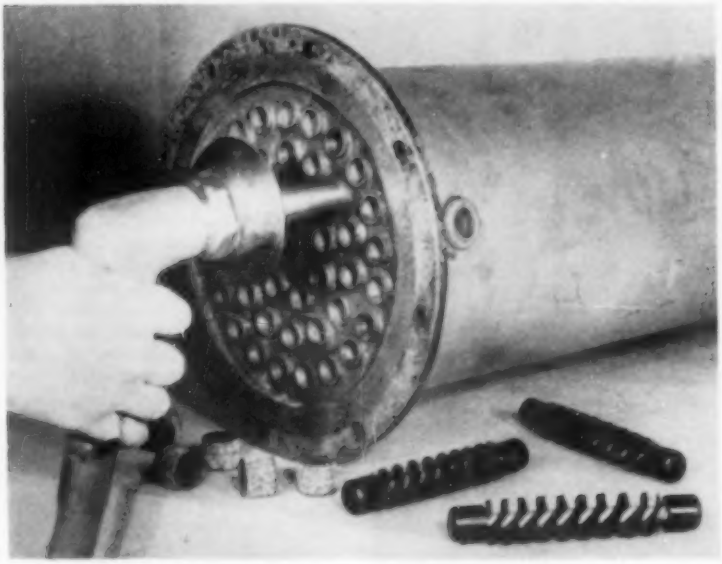
Circle No. **2** *on Reply Card*



New Valve Combines Action of Gate Valve and Line Blind

. . . permitting full view visibility of the valve wedge at all times. A glance is all that is required to determine whether the valve is full open or full closed. Valve seats are an integral part of the body, and both the wedge and the valve seats have stainless trim for anti-corrosive properties. The "Visible Wedge" valve is rigid so that no line movement is necessary to open or close the valve. A hand wheel enables the operator to open or close the line in less than a minute. Precision metal-to-metal fit of wedge and seats provides a positive line shut-off. Hamer Valves, Inc., 2919 Gardenia Ave., Long Beach, Calif.

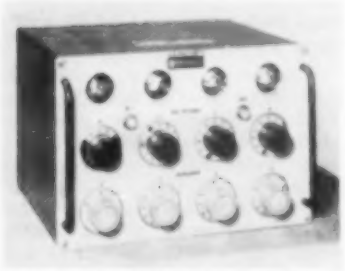
Circle No. **3** *on Reply Card*



"Gun" Cleans Condenser Tubes

A plug shooting or washing method for removing soft deposits such as mud, algae, etc., from condenser tubes uses hydraulically actuated plugs or brushes. The "Blo-Gun" is made of aluminum and weighs only 2 lb. The user may select either a corded-rubber plug or nylon spiral brush. Plug and brush projectiles come with outside diameters in the range between ½-in. and 1-in. The plug's irregular surface gives it a brush effect. The brush itself is of stiff nylon terminating in a plug. Its ends are slightly less in diameter than the diameter of the tube, and water is thus free to flush ahead of the brush as it proceeds through the tube. Both plugs and brushes may be used repeatedly. To use, the plug or brush is first placed in the tube, and the nozzle of the "Blo-Gun" is inserted. By a continued forward movement, compressed air or water is released, propelling the accessory forward through the tube. Thomas C. Wilson, Inc., 21-11—44th Ave., Long Island City 1, N. Y.

Circle No. **4** *on Reply Card*



Automatic Digital Controller Runs Refinery Valves

. . . within preset limits, controls batch mixing operations and other operations. In process control operation, where a pressure is measured by a transducer or a temperature by a thermocouple, the upper and lower operating limits may be set. If the temperature or pressure tends to move out of these limits, the controller can operate a valve to reduce the temperature or pressure to a safe level automatically. In a mixing operation with 10 batches of solution A to be mixed with 25 batches of solution B, a count of 10 switches the flow from A to B, and a count of 35 ends the cycle and switches back to A. The controller unit is 7 in. high, 10 in. wide and 8 in. deep, having a count capacity of 2500 counts and adds and subtracts automatically at rates up to 20 decimal digits per second with an accuracy of 0.04%. The controller contains two 50-position stepping switches connected to permit 50 x 50 or 2500 counts. Counts come into the switches from any pulsing device used as a transmitter, such as a mechanical switch, photocell, transducer, or thermocouple. The counts are stored in a register, and the number is shown on the light bank of four Inditron tubes. American Electronic Mfg., Inc., 9503 W. Jefferson Blvd., Culver City, Calif.

Circle No. **5** *on Reply Card*

Corrosion-Proof PVC Laminate Protects Tanks and Vessels

. . . by combining the corrosion resistance of unplasticized polyvinyl chloride on one side of laminate and the flexibility of plasticized polyvinyl chloride on the other side. Called "Vyflex FL-85," it can be bonded to steel, concrete, or wood without requiring a cure. With a maximum operating temperature of 200° F., the lining resists a broad group of oxidizing and non-oxidizing acids, concentrated alkalis, salts, etc., Kaykor Industries, Inc., Yardville, N. J.

Circle No. **6** *on Reply Card*

New Saybolt Viscosimeter Tests up to 475° F.

. . . for determining the viscosity of asphalts, road oil and fuel oils. The viscosimeter bath is a solid aluminum block equipped with heaters of high temperature sheath chromolox ring type and circular band type. A transite asbestos lid covers the aluminum block. Rockwool insulation, 1½-in. thick, surrounds the aluminum block. Holes in the block accommodate two standard Saybolt viscosity tubes. Sensitivity of control at a bath temperature of 450° F. is ±1° F. Emil Greiner Co., 20-26 N. Moore St., New York 13, N. Y.

Circle No. **7** *on Reply Card*

Orifice-Gasket Combination Speeds Field Installation

. . . in pipelines. A flat plate disc is deeply rebated under pressure into a standard ring gasket. The plate is micrometer machined and precision ground to minimize turbulence. The plate hole is bored in the field to meet the needs of existing conditions. Advantages claimed for the one-piece construction are the simplicity of installation and the safety as compared to multi-piece plates held in place by machine screws which can loosen and cause damage to equipment. The Mac Iron Works Co., 123 Warren St., Sandusky, Ohio.

Circle No. **8** *on Reply Card*

Emergency Storage Battery Is Underwriters' Approved

. . . and is designed specifically for emergency lighting. Claimed to be the first plastic-cased storage battery to be approved by the Underwriters' Laboratories, an eight to twelve year life is anticipated for the "3-COE-7 Tytex." Used for laboratories, industrial plants, communication centers, switchgear and relay actuation, signal control circuits for alarm systems, and other applications, the battery prevents short-circuits by triple insulation with inert plastic and rubber. Low internal resistance is claimed. The case and cover are made of polystyrene, which is impervious to the electrolyte, lightweight, and easy to clean. State of charge is indicated by colored pilot balls floating in a vertical channel molded into one corner of the container, and may be observed from distances up to thirty feet. Water addition is required only once or twice a year. The battery is normally supplied with electrolyte, charged for immediate service. Exide Industrial Div., The Electric Storage Battery Co., Box 8109, Philadelphia 1, Pa.

Circle No. **9** *on Reply Card*

Sprayable Foam Insulation Protects with Single Coat

. . . and consists of a resinous liquid sprayed like paint. After a few minutes it has swollen to a thick, airy cushion, and after fifteen minutes foaming has ceased. Called "Poly-Cell," it consists of two liquids which must be blended in exact proportions, and heated to a certain temperature before use in the spray gun. Special equipment is furnished, and the manufacturer's service engineers can train a sprayman in a short time. The sprayed material does not support combustion, contains no volatiles, can be sprayed near flames, and two hours after spraying is claimed to be rigid enough to support a man's weight. One gallon will form a ⅜-in. foam coating over 100 sq. ft. of surface. "Poly-Cell" foam weighs about 2 lb./cu. ft., and has a K factor of 24/in. The high temperature limit is 225° F., and it has been tested as low as —40° F. Insul-Mastic Corp. of America, 1141 Oliver Building, Pittsburgh 22, Pa.

Circle No. **10** *on Reply Card*

Plasticized Glass Fiber Tape Protects Underground Pipes

. . . and fittings on oil and gas transmission and distribution lines. "Duratape" is also suitable for patching existing coatings. Designed as a dielectric barrier against corrosion, it is made of pyrex-type glass fiber mat with reinforcing strands of glass yarn. The glass mat is coated on both sides with plasticized coal tar. The tape is pliable, suitable for hand wrapping, and conforms to irregular contours such as elbows, joints, and other fittings. Tensile strength is 29 lb. per lineal inch, and nominal thickness is 0.070 in. To apply the tape, the pipe is cleaned thoroughly by wire brush or scraping, then coated with a coal tar base primer which is allowed to dry from one to three hours. The tape is then spiral wrapped on the pipe using a 50% lap while flashing the inner side of the tape with a wide-mouth butane torch. After wrapping, the exterior is flashed to form a smooth sealed coating with a nominal thickness of 3/32 in. Tape weighs 36 lb. per 100 sq. ft. and comes in 50-ft. lengths 2, 4, 6, 18, and 24 in. wide. Glass Fibers Inc., Mat Div., 1810 Madison Ave., Toledo 2, Ohio.

Circle No. **11** *on Reply Card*

New WATSON-STILLMAN
150 LB. STAINLESS STEEL
PIPE FITTINGS, *Types 304, 316*

Now you can get performance-proved Watson-Stillman Fittings for standard pressure services that need the corrosion resistance, heat resistance and low temperature toughness of 18-8 Stainless Steel.

W-S 150 lb. Stainless Fittings, rated at 400 psi cold non-shock working pressure and 150 psi steam pressure, are ideal for process piping, refrigeration systems, high temperature liquid and gas piping and other piping systems. They are available in both Screw-End and Socket-Welding Types in sizes ⅛" to 2".

The new Watson-Stillman Stainless Steel Fittings will assure you of long, trouble-free service in tough piping applications... will reduce down-time and cut maintenance costs. For full technical information on these fittings write today for Bulletin S-3-55.

Sold Through Leading Distributors

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.
Roselle, New Jersey

10

New Automatic Recorder Is for Universal Laboratory Use

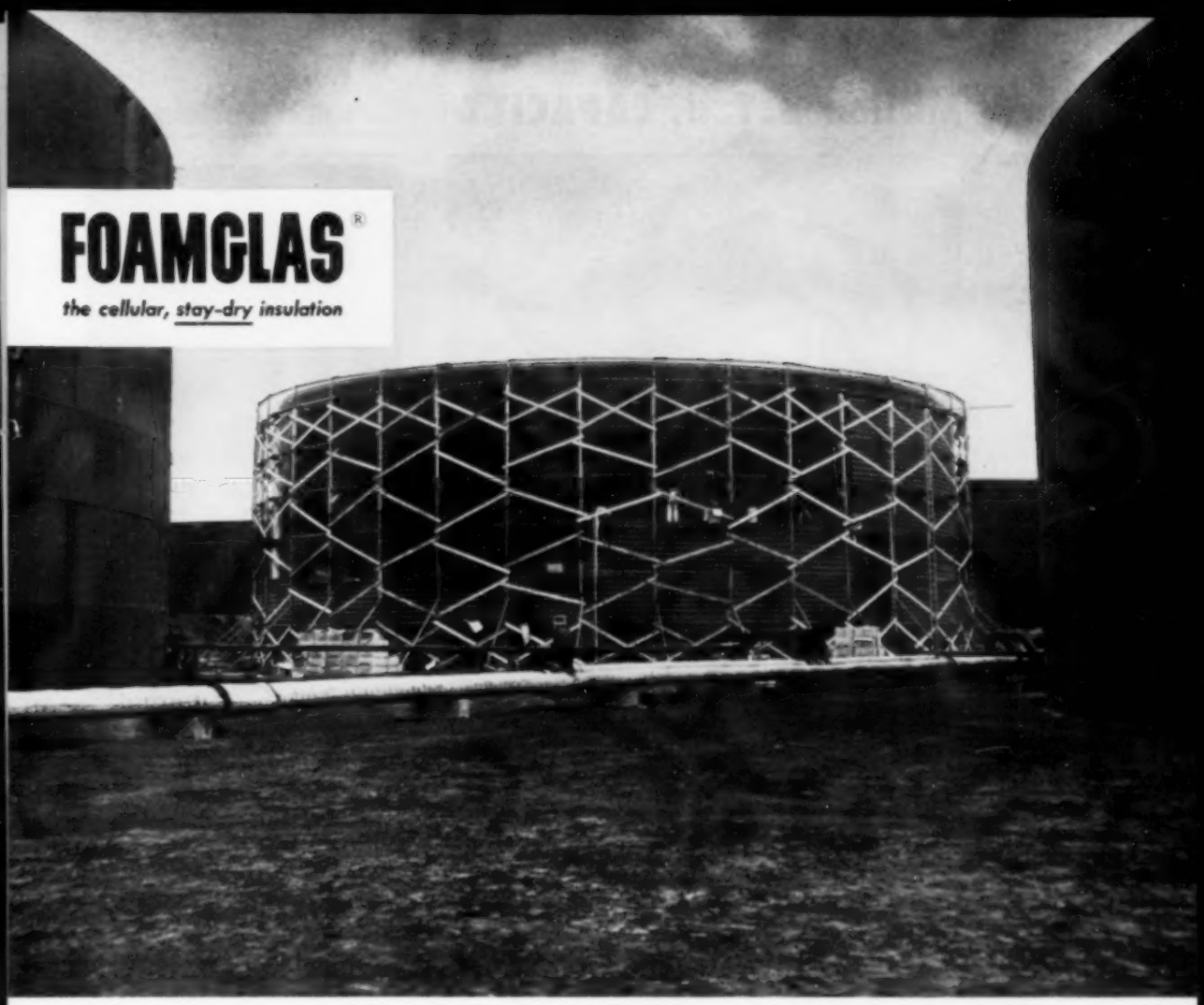
. . . in the continuous recording of any operation that produces a change in potential, current, or resistance. The "Recordall" plots d.c. voltage or current, resistance, or temperature (from —100° to 1000° C.) directly as a function of time. Adapters are available for recording readings from pH meters, polarographic analyzers, and other instruments. The desired function to be recorded is selected by a six-way switch on the control panel. Other switches select the recording range. A dual-range strip-chart is used with a pen that covers the full 11-in. scale in 3 seconds. Eleven ranges record d.c. potential and d.c. current, and 6 ranges are available for resistance. Temperature range choices are —100° to 120° C.; 100° to 320° C., or with a chromel-alumel thermocouple, from 0° to 1000° C. Accuracy is claimed better than ±0.5% full scale. Chart speeds are 3.75 to 60 in./hr. in 11 ranges. Power is 115-volt, 60-cycle a.c. Fisher Scientific, 717 Forbes St., Pittsburgh 19, Pa.

Circle No. **12** *on Reply Card*

(To obtain more data on advertised products see page 564)

FOAMGLAS®

the cellular, stay-dry insulation



Only FOAMGLAS insulation can stay dry at 120°F on these fuel oil storage tanks

FUEL OIL CORPORATION officials faced a serious problem when their supply of steam needed to heat heavy fuel oil at River Rouge, Michigan was curtailed. They solved it by insulating their four massive storage tanks with FOAMGLAS to cut the volume of steam required to heat the oil. They say:

"We picked FOAMGLAS because it can't absorb the moisture that cuts insulating efficiency. This was most important since the 120°F temperature of the stored oil could not dry out moisture that might be absorbed by ordinary insulations. With FOAMGLAS, we get constant insulating efficiency to keep oil heating steam requirements at a money-saving minimum.

"We save money, too, because we get this lasting insulating protection without high insulation replacement and maintenance costs. Even oil spillage and corrosive industrial atmospheres can't damage fireproof, acid-proof FOAMGLAS."

It will pay you to find out today how you, too, can save money by using FOAMGLAS. Write for our booklets on insulation for piping, tanks and other equipment.

Pittsburgh Corning Corporation

Department PP-45, One Gateway Center
Pittsburgh 22, Pennsylvania
In Canada: 57 Bloor St. W., Toronto, Ontario

Flat 2" blocks of FOAMGLAS are applied to surface of 117' dia., 41' high tank. Blocks were banded in place then sprayed with coat of asphalt cutback. Insulation Contractor was G. H. Gotshall Co., Detroit, Michigan.

Thirty Million B.T.U. CAPACITY

NIAGARA Aero HEAT EXCHANGER

Cooling in Chemical Processes with Precise Control of Temperature

The NIAGARA Aero HEAT EXCHANGER cools liquids and gases by evaporative cooling with atmospheric air, removing the heat at the rate of input, controlling temperature precisely. You save 95% of cost of cooling water; you make great savings in pumping, piping, power; quickly recover your installation cost.

You can cool and hold accurately the temperature of all fluids, air and gases, water, oils, solutions, chemical intermediates, coolants for mechanical, electrical and thermal processes. You obtain closed system cooling free from dirt. You solve all the problems of water availability, quality or temperature.

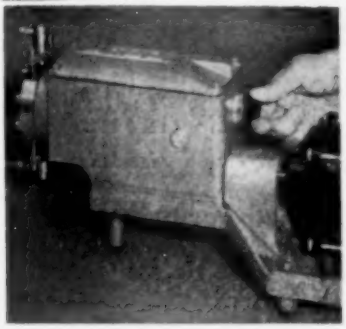
In CHEMICAL PROCESSES this is successfully used in cooling liquids and gases, chemical reactions, condensing distillations and reflux cooling.

Write for complete information; ask for Bulletins 120 and 124. Address Dept. PP.

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N.Y.

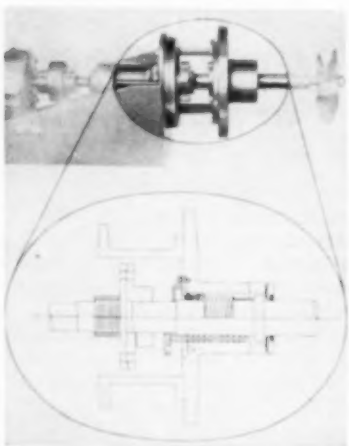
District Engineers in Principal Cities of United States and Canada



Diaphragm Pump Feeds at Micro Flow Rates

. . . for pumping, metering, feeding and proportioning fluids. The "Micro-flo Pulsafeeder Pump" operates on the piston-diaphragm principle so that the pump material does not contact the pumping parts. The maximum flow rate is 2400 ml./hr. and the pump will operate against pressures up to 1000 psig. A standard 1/20-hp electric motor without gear reduction can be used. Pumping rate is set by establishing the length of the piston stroke by a hand set dial indicator calibrated in 1000 increments which can be set while the pump is idle or operating. Designed for use in laboratories and pilot plants, it can also be used for controlled volume additives in process industries. Lapp Insulator Co., Inc., Process Equipment Div., 7 Gilbert St., LeRoy, N. Y.

Circle No. **13** *on Reply Card*

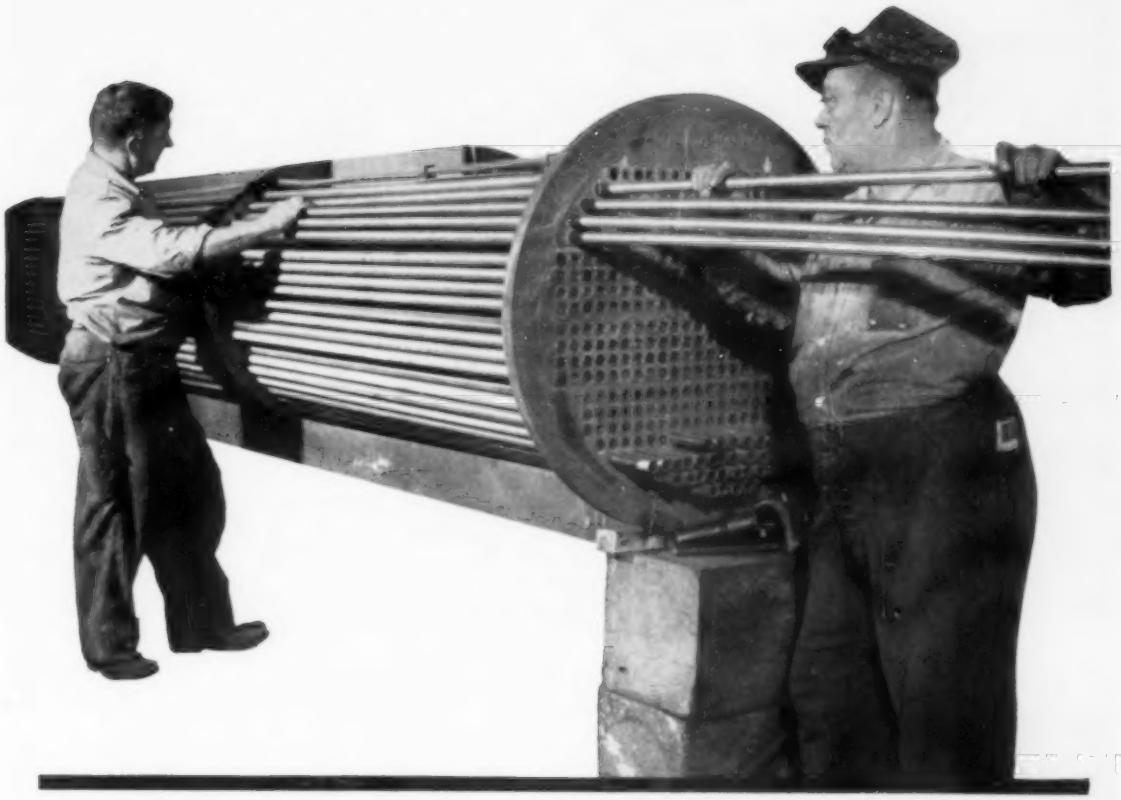


Mechanical Seal Can Be Replaced Under Full Pressure

. . . while installed on a shaft entering a vessel by means of a secondary seal which shuts off the tank while the mechanical shaft seal is being serv-

TO MAINTAIN HIGH PRODUCTION

AND REDUCE DOWN-TIME...



ESSO installs 7,956 Anaconda Cupro Nickel, 30%-702 Tubes in condensers and coolers at Bayway Refinery

This condenser is used in the No. 1 Fluid Catalytic Cracking Unit at the Bayway Refinery of Esso Standard Oil Company at Linden, N. J. The unit produces about 25,000 barrels of petroleum products daily—ranging from high octane gasoline to heating oils.

7,956 ¾" Cupro Nickel, 30%-702 Tubes were supplied by Anaconda for the condensers and coolers of this cracking unit. On the shell side, these tubes are subjected to temperatures as high as 350°F at 75 PSI by process streams containing both sulfur and salt compounds. On the tube side, the summer salt water temperature ranges from 80°F at the inlet to 110°F at the outlet.

Information gathered from test runs within the refinery indicates these ANACONDA Cupro Nickel, 30%-702 Tubes have a life expectancy in this service of from 6 to 12 times greater than tubes made of Admiralty Alloy.

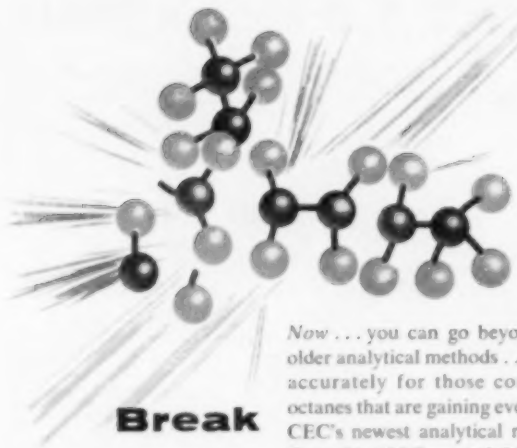
ANACONDA Cupro Nickel, 30%-702 Tubes are recommended where process liquids, vapors and cooling waters are corrosive—particularly where temperatures are too high for other copper alloys. Tubes of this alloy also have superior resistance to sea water at high velocities. They have good physical properties at elevated temperatures and resist stress-corrosion cracking.

Our files bulge with a collection of tube performance case histories that can answer many of the corrosion problems you face. We can put the information in these files to work for you at once—to help you select the one best alloy for your job. Write, outlining your operating conditions, to Dept. TD, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Ont.

ANACONDA®

Tubes and Plates for Condensers and Heat Exchangers

(To obtain more data on advertised products see page 564)



Break through the octane barrier

Now . . . you can go beyond the limitations of older analytical methods . . . analyze quickly and accurately for those compounds above the octanes that are gaining ever-greater importance. CEC's newest analytical mass spectrometer . . . Type 21-103C . . . quickly, accurately determines mixture components at mass numbers as high as 700 . . . yet is equally at home in the field of gases and light liquids.

Only an hour or less is required for even complex mixture analyses (just minutes for key components) that once took weeks by fractional-distillation methods.

For fundamental petroleum and petrochemical research, for process development and for control, investigate the 21-103C. It makes an already important scientific tool—mass spectrometry—even more useful and versatile.

Complete details in our new brochure . . . send today for CEC 1800C-X10.

Ideal for exploratory analyses, the 21-103C registers every component of a sample . . . whether or not its presence is known.

Consolidated Engineering

Corporation

ELECTRONIC INSTRUMENTS FOR MEASUREMENT AND CONTROL

300 North Sierra Madre Villa, Pasadena 15, California

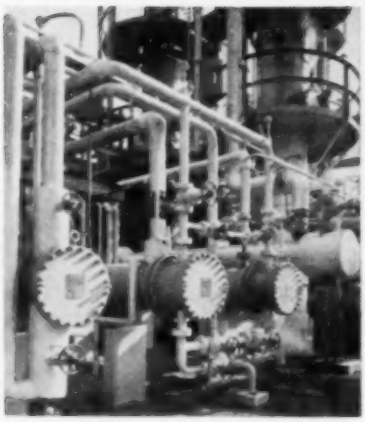
Sales and Service Offices Located in: Albuquerque, Atlanta, Buffalo, Chicago, Dallas, Detroit, New York, Pasadena, Philadelphia, Seattle, Washington, D. C.

iced. The annular area occupied by the mechanical seal permits quick substitution of a conventional stuffing box in the event mechanical seal replacement parts are temporarily not available. Also the "Nettco" side drive seal affords positive protection against loss of product in case of seal failure by means of a seal-off gasket isolated from the contents of the tank by a secondary diaphragm. New England Tank & Tower Co., Everett, Mass.

Circle No. **14** *on Reply Card*

Continuous Pipeline Mixer Is For Liquids, Gases or Slurries

. . . working directly in the pipeline and providing uniform blending of one or more chemicals into the main stream without the use of a mixing tank. The "Homomix" is designed and built with one or more stages, each of which consists of a diffusing impeller rotating in a blending chamber, driven by a continuous shaft direct-connected to the prime mover or motor, and discharging directly across the flow-through stream. Visual examination of the mixing action is provided by a transparent plastic observation port which may be opened for physical examination of the rotating element. Installation may be vertical, horizontal or inclined in any pipe line. Head loss



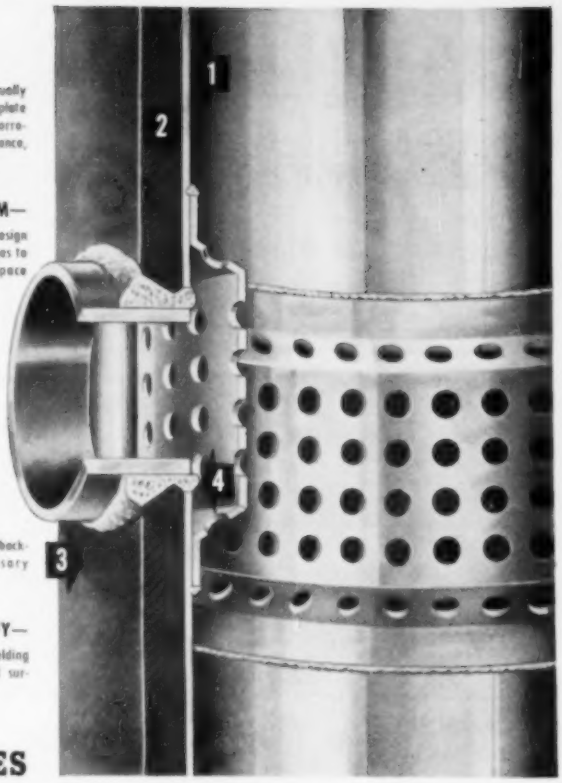
Stainless-clad steel checks corrosion in these acid stripping and cooling units handling naphthenic acid at 350° F.

1 ECONOMY—
High alloy layer—usually 10% or 20% of total plate thickness — assures corrosion and abrasion resistance, long equipment life.

2 DESIGN FREEDOM—
Integral bond allows design and fabrication of shapes to meet process and space needs.

3 STRUCTURAL STABILITY—
Low-cost carbon steel backing provides necessary strength and rigidity.

4 EASY TO MODIFY—
Normal cutting and welding will not endanger clad surface or bond.



CLAD STEEL EQUIPMENT ASSURES

LONG LIFE AND EASY MODIFICATION

To help you lengthen profitable service life *and* overcome the factor of high first cost, clad steel equipment offers two unique advantages. First, clad steel construction permits easy tank and pressure vessel revision when new openings must be cut and flanges or pipes welded on. The bond between cladding and backing is not affected by the temperature range where clad can be applied. This eliminates seepage and crevice corrosion.

Second, you get all the benefits of solid high alloy's corrosion resistance and protection with savings up to 50% in material costs. Because cladding and backing are bonded over their entire surface, the API-ASME Code permits full gage consideration for design purposes.

Long service life and low cost protection, plus other advantages such as economical field erection and easier drainage, cleaning and inspection, can be obtained from 16 cladding materials. *Qualified* equipment builders know best how to apply these to your new processing equipment. By working with your own engineers and consultants from the start, they can help you get longer equipment life at lower cost. Lukens offers the widest available selection of clad steels—stainless, nickel, Inconel, Monel, copper—and cooperates with fabricators in helping you to select the type best suited to your needs. If you would like more information, consult one of your builders or write Manager, Marketing Service, Lukens Steel Co., 751 Lukens Building, Coatesville, Pa.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE

(To obtain more data on advertised products see page 564)

GET YOUR FREE COPY . . .

. . . of the 1954 Editorial Index for PETROLEUM PROCESSING. It is now ready, and we'll be glad to send you yours.

Circle No. 80 on the Reader's Service card in this issue (you'll find it between pages 564 and 565), fill in your name and address, and drop the card in the mail. We'll do the rest.

—The Editors

FREE!

Alcoa Book Gives You the Facts on the Lowest Cost Corrosion-Resistant Rigid Conduit!

Be ready with the answers when the question of corrosion-resistant conduit comes up! Come up with the right answer, the lowest cost answer: Alcoa® Aluminum Electrical Rigid Conduit.

You'll find all the facts on this lowest cost corrosion-resistant, non-magnetic rigid conduit in this book published by Alcoa. Facts on applications, advantages, installation, and sizes. Send for your free copy, today. Have the facts at your finger tips when you need them!

Just fill out the coupon and mail to: ALUMINUM COMPANY OF AMERICA, 2093-D Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Gentlemen:

Please send me your book on the lowest cost corrosion-resistant rigid conduit: Alcoa Aluminum Electrical Rigid Conduit.

Name _____ Title _____

Company _____

Address _____

City _____ State _____

New Alcoa Aluminum Bus Conductor makes bus systems stronger, lighter; cuts costs! Bus systems using Alcoa's new No. 2 EC bus bar provide the best combination of strength, light weight and conductivity at a saving of up to 10%. Specify Alcoa Aluminum Bus Conductor.

is low, but if additional head is required, a lift-stage employing an axial flow impeller may be incorporated in the unit. Interior surfaces of the body and diffusing chambers may be protectively coated. The "Homomix" can be used indoors or outdoors. American Well Works, Aurora, Ill.

Circle No. **15** *on Reply Card*

Electrode Controls Liquid Level At Pressures to 4000 PSI

. . . and temperatures up to 800° F. Metal parts of the "WCC" series of liquid level control electrodes are of stainless steel. Aluminum oxide of 95 + % purity and 200,000 psi compressive strength replaces the old style mica insulation to permit high pressure operation. The electrodes are equipped with connecting nuts for attaching probes of any desired length or shape. Manufacturing specifications for the "WCC 12" electrode shell include a ⅝-in. 24 pitch thread with the probe connected by a ¼-in. 20 pitch connecting nut. The "WCC 121" differs in that the probe connection is fitted with a #10-24 pitch connecting nut. The "WC 1138" is made with a ⅜-in. dryseal pipe-threaded shell and fitted with a ¼-in. 20 pitch connecting nut. In addition to the above standard sizes, high pressure liquid level control electrodes are manufactured to individual specifications. Auburn Spark Plug Co., Auburn, N. Y.

Circle No. **16** *on Reply Card*

That's the long-life valve on sulphuric acid

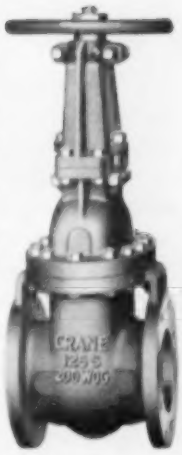
THE CASE HISTORY: At a large midwestern refinery there were recently two valves of different makes on a 90% sulphuric acid line. As seen in the photo above, these valves worked under identical conditions, almost side by side—each operated about three times daily.

Less than a year in the line, the valve at left started leaking, with the leak getting rapidly worse. In contrast, the Crane No. 475½ all-iron gate valve at right, with two years' continuous service to its credit, was still giving completely good performance.

That's Crane quality in valves—with a 100-year background in quality manufacturing. That's why Crane valves are the first choice of thrifty buyers in the petroleum industry as in all others. Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all industrial areas.

CRANE IRON BODY WEDGE GATE VALVES

Here are valves of unusual strength for their 200-pound W.O.G. rating. Body and bonnet are oval shaped, with extra metal where needed most. Their Crane-quality cast iron with highly engineered operating design makes these valves outstanding performers wherever they're used. A complete family to choose from. See your Crane Catalog or your Crane Representative.



CRANE CO.

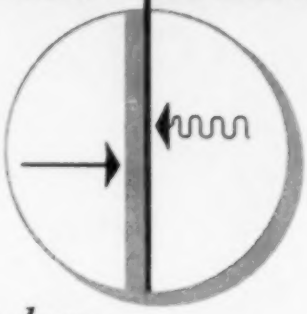
VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

(To obtain more data on advertised products see page 564)

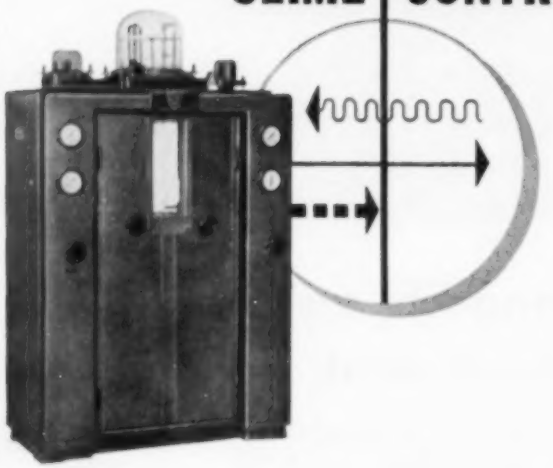
Where you need

HEAT | EXCHANGE



Be sure you have

SLIME | CONTROL



Whether you heat or cool water for make-up, process or any other use, you will need Wallace & Tiernan Chlorination to help combat slime problems introduced by water-borne bacteria or air-borne bacteria.

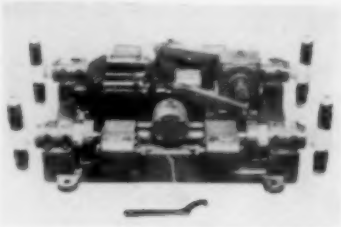
With slime control equipment designed for any need, built for lasting and dependable service, highly accurate and backed by over 40 years of successful application experience, Wallace & Tiernan Chlorination can help you increase the efficiency of your plant and cut operating costs. For further information write our Industrial Division.

WALLACE & TIERNAN

25 MAIN ST., BELLEVILLE 9, N. J.

CHLORINATORS • CHEMICAL FEEDERS • SCREENING EQUIPMENT • MAGNETIC SEPARATORS • PRECISION PRESSURE INSTRUMENTS • CATHODIC PROTECTION • FINE CHEMICALS

CD-38



New Plastic and Ceramic Pumps Proportion Corrosive Liquids

. . . such as ferric chloride, sodium hypochlorite, cupric chloride, and hydrochloric, hydrofluoric and nitric acids. The "U" type pump has liquid end pump bodies and check valve assemblies made of unplasticized polyvinyl chloride or Kel-F. Used in conjunction with ceramic pump plungers and ceramic check valve balls, these pumps are resistant to liquid corrosives. Capacities are up to 19 gph per feed, and all are available in one, two, three or four feed units. Pumps with plunger diameters from ¼-in. to ½-in. may be used to develop pressures up to 300 psi, and ⅝-in. to 1-in. plungers for pressures up to 150 psi. Maximum temperature for pumps of PVC is 150° F. and for Kel-F is 250° F. Plastic liquid end assemblies are interchangeable with the metallic liquid ends in "U" type pumps and may be used to convert from metal to plastic operation. Hills-McCanna Co., Pump Div., 3025 N. Western Ave., Chicago 18, Ill.

Circle No. **17** *on Reply Card*

Free Trade Literature

Catalytic Desulfurization

. . . of petroleum distillates: *Heat Engineering, Jan.-Feb. 1955* discusses catalytic desulfurization without hydrogen, with recycle hydrogen, and with recycle and make-up hydrogen; gives flow diagram, operating variables, process conditions, economic evaluation, unit operating cost, and the effect of various operating parameters. Foster Wheeler Corp., 165 Bdwy., New York 6, N. Y.

Circle No. **18** *on Reply Card*

Portable Water Chlorinator

. . . applying the diaphragm regulator principle to gas chlorinators for the first time: *Catalog 70-49* describes the light weight, noncorroding plastic construction of the chlorinator, gives capacities and other information. Fischer & Porter Co., Hatboro, Pa.

Circle No. **19** *on Reply Card*

DAVISON M-S® Catalyst

The Petroleum Industry's MOST WIDELY USED CATALYST!

- Narrow range of particle size distribution
- Low impurities
- Outstanding physical and catalytic characteristics
- Excellent attrition resistance

These are some of the reasons why Davison's Catalysts are the most widely used synthetic cracking catalysts in the petroleum industry. Throughout the world, Davison's catalysts crack more gas oil than any other catalyst.

Write today for a folder giving all the facts on Davison's M-S Catalysts . . . particle size distribution, chemical, physical and catalytic properties, etc.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

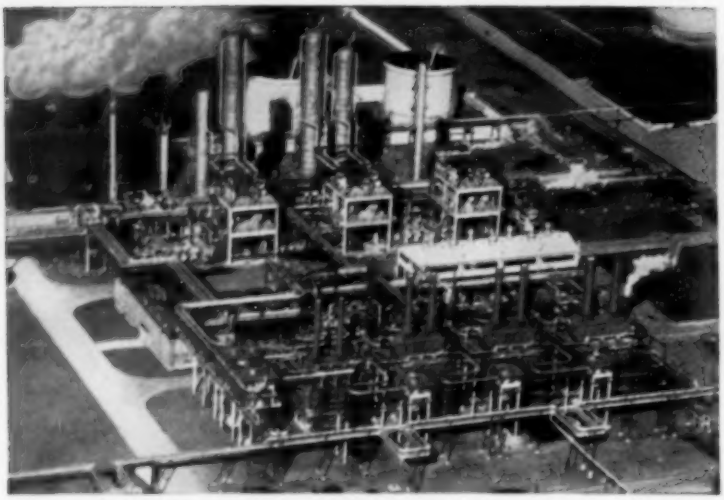
Division of W. R. Grace & Co.

Baltimore 3, Maryland

Sales Offices: New York, N. Y.; Chicago, Ill.; Houston, Texas

Producers of: Catalysts, Inorganic Acids, Superphosphates, Triple Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides. Sole Producers of DAVCO® Granulated Fertilizers.

(To obtain more data on advertised products see page 564)



Prefractionation and catalytic reforming section of Sun Oil Company's petrochemical plant at Marcus Hook, Pa.

BENZENE, TOLUENE, OR MIXED XYLENES ...Sun Contributes To Major Industries

Sun Oil Company can produce from a single plant, an annual rate of 19,000,000 gallons of benzene, 19,000,000 gallons of toluene, and 15,000,000 gallons of mixed xylenes . . . aromatic chemicals essential for industries such as rubber, textile, plastics, and for defense purposes.

The $15,000,000 petrochemical plant covers an area of 20 acres. Its maze of piping and vessels were designed for operational flexibility so that relative proportions of major products could be varied to meet any market demand. Substantial quantities of valuable by-products such as hydrogen, propane, butane, pentane, narrow boiling-range naphthas, and high-octane gasoline, can also be produced here.

The Kuljian Corporation was one of the firms co-operating with Sun's Engineering Staff in the design and engineering of the prefractionation and catalytic reforming sections as shown above.

Next time your plans call for a complete new plant, alterations, or expansion, find out how Kuljian services can be of help. Whether your problem is one of design, engineering or construction, our vast facilities and technical know-how can be made available to you anytime . . . anywhere. Your inquiry would be most welcome.

A booklet "New Aromatics Plant" tells you the complete story. Why not write for your copy today.

The Kuljian Corporation

engineers • constructors

1200 North Broad Street • Philadelphia 21, Penna.

MEXICO CITY • CARACAS • BOGOTA • MADRID • ATHENS • BEIRUT • TOKYO • CALCUTTA • RANGOON

What's New!

Vinyl Plastisol Resin

. . . a colloidal dispersion of "Opalon 410" resin in a plasticizer: 22-page report on *Opalon 410 Stir-In Vinyl Resin* discusses plastisols; ingredients such as resin, plasticizer, filler, pigment, stabilizer, and surface active agent; mixing; deaeration; fusion; and applications for coating, slush molding, dip coating, casting, foams and sprays and plastigels. Monsanto Chemical Co., Plastics Div., St. Louis 4, Mo.

Circle No. **20** *on Reply Card*

Tubing Steel Analyses

. . . for standard carbon, alloy, and stainless used for elevated temperature and pressure service: *Technical Data Card 177* shows the chemical analyses with cross-indexing to associate grade and ASTM specifications which are listed for tubing and pipe by number and title. Babcock & Wilcox Co., Beaver Falls, Pa.

Circle No. **21** *on Reply Card*

Liquid Level Measure & Control

. . . for continuous, semi-continuous and batch processes: 20-page *Bulletin 1161* discusses basic principles of liquid level measurement, control and transmission, and describes detailed systems, applications, principles of operation, limitations and advantages of each. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **22** *on Reply Card*

Titanium and Stainless Pipe

. . . and tubing for corrosive services: *T.D. 115-Titanium Tubing and Pipe* and *T.D. 116-7 Mo Stainless Tubing and Pipe* give physical properties, corrosion resistance, applications, hot and cold working instructions, and other information. The Carpenter Steel Co., Union, N. J.

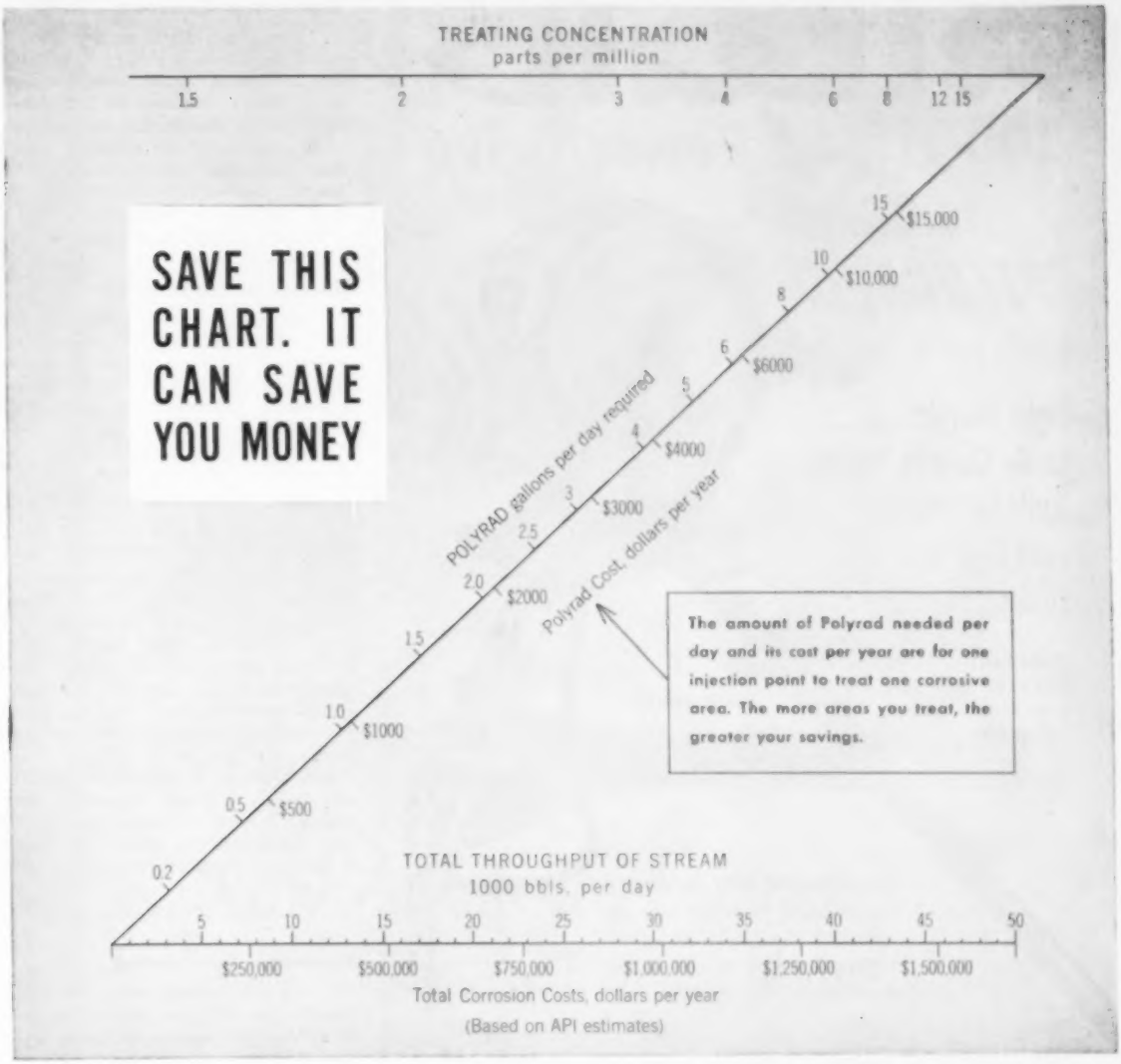
Circle No. **23** *on Reply Card*

Brazing Manual

. . . concerned with the application of the major brazing methods in joining metals using silver alloys and filler metals, fluxes, and gas atmospheres: 24-page *Catalog 925* includes over twenty tables, drawings, and photographic illustrations discussing silver brazing procedure, selection of brazing and filler metals, design of brazed joints, prebraze cleaning, assembly of brazed joints, and others. Air Reduction Sales Co., Inc., 60 E. 42nd St., New York 17, N. Y.

Circle No. **24** *on Reply Card*

HOW POLYRAD CUTS CORROSION COST



With this chart you can quickly get an idea of how much you can save in your refinery—at so little cost—with Polyrad corrosion inhibitor. Just connect points at the top and bottom lines with a straight edge. The intersection with the diagonal bar gives the cost of Polyrad to treat that area for one year. The total cost of Polyrad for all areas treated in relation to the total refinery corrosion cost (also shown on bottom bar), indicates the remarkable returns possible.

For example, a refiner treated 25,000 bbl. a day throughput with Polyrad at 6 ppm. at an annual inhibitor cost of $6,000 for this area. In relation to this refinery's total corrosion bill of $800,000 a year, the cost of Polyrad treatments reaped big dividends.

Polyrad is readily available from stocks maintained throughout the country. A Hercules technical representative will be glad to work with you in evaluating this Hercules corrosion inhibitor under your specific operating conditions.

Naval Stores Department

HERCULES POWDER COMPANY

984 King Street, Wilmington 99, Delaware

POLYRAD®

FILMING AMINE INHIBITOR

(To obtain more data on advertised products see page 564)

New

RIDGID

200 Tripod Power Drive

with

SPEEDCHUCK

Light Weight...
Easily Quickly Set Up...
Built-In Folding
Tool Tray and
Folding Legs

Power for any hand pipe tools — ⅛″ to 2″ pipe, ¼″ to 2″ bolts; geared tools to 12″.

Pats. Applied For

Leg Spacing and Tool Tray assure solid rigidity, greater strength . . . No front leg to obstruct swing of die stock handles.

Fast Easy Chucking, new principle—guaranteed to grip tight both forward and reverse, won't slip, even with geared tools . . . 3-jaw centering device turns with pipe . . . Extra-powerful motor, larger brushes, longer commutator.

Your Supply House has it—
ready to demonstrate and expedite your order:

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

RIDGID

Work-Saver Pipe Tools

What's New!

Uranium in Colorado

. . . in the colorful mesa country where thousands of people are mining and processing uranium ores: 36-page *Mesa Miracle* describes the fast growing uranium industry and includes up-to-date figures on mines now in operation and other information. United States Vanadium Co., Room 308, 30 E. 42nd St., New York 17, N. Y.

Circle No. **25** *on Reply Card*

American Standards List

. . . published for 1955: 48-page publication lists and indexes about 1500 American Standards including petroleum, chemical, mechanical, construction and civil engineering, and many others, giving prices for each standard. American Standards Association, 70 E. 45th St., New York 17, N. Y.

Circle No. **26** *on Reply Card*

Pneumatic Instrumentation

. . . for control and transmission systems: 44-page *Bulletin 1120* describes pneumatic controllers; their applications and how they work; also describes pneumatic transmission systems; cascade, ratio and other interconnected control systems; and practical information for the plant operators on how to tune pneumatic controllers to a process, how to introduce manual adjustments, and how to provide the best air supply. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **27** *on Reply Card*

Rotameter Information

. . . for flow measurement: 19-page *Bulletin No. 115* gives information for "Full-View" rotameters including side plate construction and safety features, flow capacity charts, design and construction details, dimension drawings, tube and float material and design data, etc. Brooks Rotameter Co., Lansdale, Pa.

Circle No. **28** *on Reply Card*

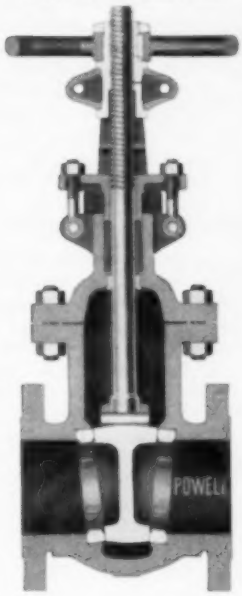
Oxidation Catalysts & Silica Gel

. . . including powdered vanadia catalyst for fluid techniques, pelleted vanadia catalyst, and indicating silica gel: data sheets *Code 902*, *Code 903*, and *IG-327* give physical forms, chemical compositions, activities (for catalysts), applications and recommended uses. Davison Chemical Co., Technical Service Dept., Baltimore 3, Md.

Circle No. **29** *on Reply Card*

POWELL VALVES ... THE COMPLETE QUALITY LINE ... POWELL VALVES

FIG. 1503 (Sectional)—
150-Pound Steel Gate Valve.



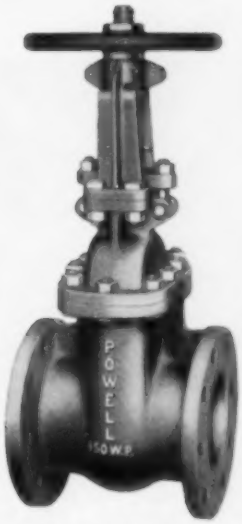


FIG. 2453-G—Stainless
Steel O.S. & Y. Gate Valve
For 150 Pounds.

FIG. 3059-G—300-Pound Steel
Lubricated Plug Valve. Gear Operated

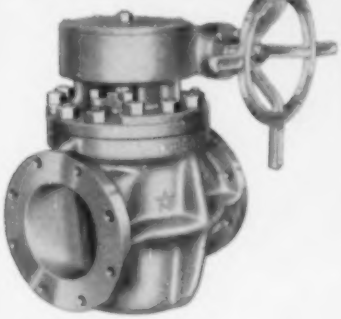


FIG. 3061—300-Pound
Steel Swing Check Valve.

POWELL VALVES ... THE COMPLETE QUALITY LINE ... POWELL VALVES

THE COMPLETE QUALITY LINE ... POWELL VALVES ... THE COMPLETE QUALITY LINE ...

POWELL VALVES ... THE COMPLETE QUALITY LINE ... POWELL VALVES

Why Petroleum Engineers Specify Powell Valves ...

. . . . *because they know Powell Valves are dependable and economical.* Petroleum engineers also know that Powell has *the COMPLETE quality line of valves.*

Investigate the many outstanding features of the Powell Valves shown here . . . as well as *the complete line* of quality valves that have a proven record of long life and dependable service.

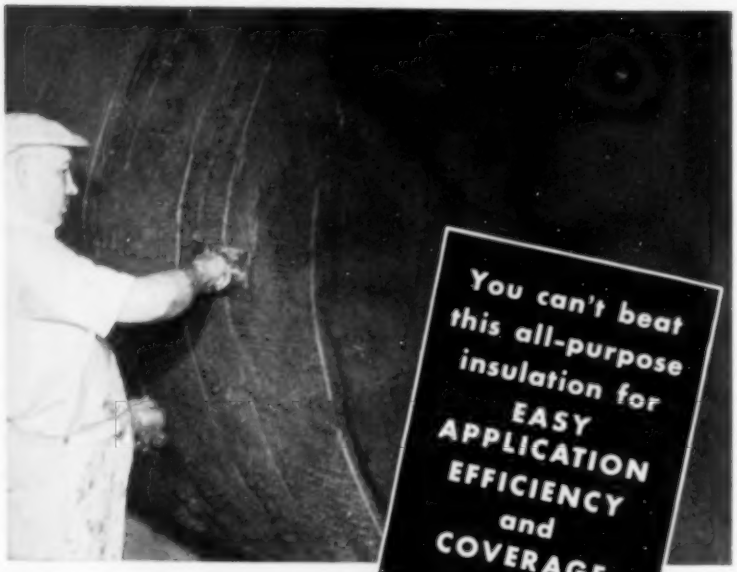
Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have.

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year

POWELL VALVES

WANTED: **PETROLEUM PROCESSING** readers

with insulation problems . . .



BALDWIN-HILL

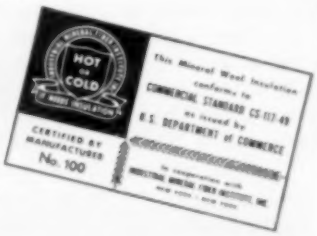
No.1 INSULATING CEMENT

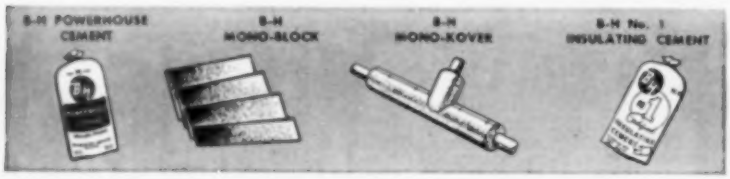
- Plastic insulation—easily troweled on large or small irregular surfaces.
- Effective up to 1800° F . . . Reclaimable to temperature of 1200° F.
- Low heat loss because of high temperature resisting mineral wool base.
- Coverage, 50 sq. ft. 1 in. thick per 100 lbs. . . . Low cost maintenance insulation.

Baldwin-Hill COMPANY

1604 BREUNIG AVE., TRENTON, N. J.

Kalamazoo, Mich. • Huntington, Ind. • Temple, Tex.





What's New!

Pneumatic Power Operators

. . . for throttling control service in the process industries: 12-page *Bulletin B-50-2* discusses use in closed control loop, how the "Cylinder Conomotor" operates, external positioning devices, features, specifications, applications to variable speed drives, valves, metering pumps, and electrical components. Conoflow Corp., 2100 Arch St., Philadelphia 3, Pa.

Circle No. **30** *on Reply Card*

Aluminum Equipment

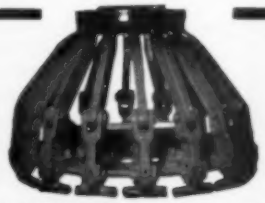
. . . for processing, storing, and transporting liquids: *Aluminum in the Process Industries* outlines technical and economic advantages, applications in processing, equipment descriptions for heat exchangers, integral steam traced piping, pipe and fittings, storage tanks, tank cars, shipping containers, etc. Aluminum Co. of America, 1501 Alcoa Building, Pittsburgh 19, Pa.

Circle No. **31** *on Reply Card*

Rubber Lined Steel

. . . for tanks, drums, pipes, valves, fittings and pumps to give corrosion resistance to inorganic acids, salts and alkalies, organic materials, etc.: bulletin on *Rubber Lining* gives details on the chemical, abrasive and temperature resistance, facilities for cementing, lining and vulcanizing, and the process for bonding rubber and steel together with a bond strength of over 500 psi. Protective Coatings Div., Metalweld, Inc., Scotts Lane & Abbottsford Ave., Philadelphia 29, Pa.

Circle No. **32** *on Reply Card*



BARRETT automatic

Filling and Crimping Equipment

for handling greases and other viscous fluids.

- No operator required.
- 100% air operated.

Fills, seals, stamps and counts lug cover pails. Output of 15 pails per minute. Write for details on installation to meet your requirements.

BARRETT Manufacturing Co.

P. O. Box 8096, Houston 4, Texas

(To obtain more data on advertised products see page 564)

INTERESTED IN UNIFINING* FOR DESULFURIZATION AND UPGRADING

* First Commercial Unifining Unit
United Refining Co.
Warren, Pennsylvania

UNIFINING should be of particular interest to all operators of catalytic reformers which produce by-product hydrogen.

• Harshaw is the exclusive producer of the Union Oil Company of California cobalt-molybdate catalyst used in the recently announced "Unifining" desulfurization and upgrading process. This rugged, commercially proven catalyst is supplied in the form of cylindrical tablets conforming to rigid physical and chemical specifications established by Harshaw and Union Oil Company of California. Stability at high temperatures permits repeated regenerations if and when necessary.

Please contact Harshaw for further information on this catalyst.

HARSHAW

THE HARSHAW CHEMICAL CO.

1945 East 97th Street, Cleveland 6, Ohio

Chicago 32, Illinois • Cincinnati 13, Ohio • Detroit 28, Michigan • Houston 11, Texas
Los Angeles 22, California • New York 17, N. Y. • Philadelphia 48, Pennsylvania
Pittsburgh 22, Pennsylvania

* Trademark of Union Oil Company of California

(To obtain more data on advertised products see page 564)

MEASURE, CONTROL LIQUID DENSITY
continuously and automatically with the

Princo Densitrol

PRINCO

Process industries will welcome the new DENSITROL—the precision instrument that gives a continuous reading of density in flowing liquids such as sugar syrups, brine, acids. DENSITROL electrical indicators or recorders can be located remote from the sampling chamber itself. If desired, DENSITROL can be linked with control mechanisms for automatic regulation. For information on temperature and pressure ranges, calibrations, and other specifics, request Bulletin W-3.

PRECISION THERMOMETER & INSTRUMENT CO.
1434 Brandywine Street, Philadelphia 30, Pa.

reodorize petroleum malodors

with **Alamask!**

Make olfactorily acceptable petroleum products!

Producers of petroleum products and of petro-chemicals – by adding a selected ALAMASK reodorant – can improve odor characteristics of such materials. A specific ALAMASK is available to achieve adequate reodorization of a variety of petroleum products.

FOR REODORIZATION OF:

FUEL OILS *(regular or premium gasoline blends)*
KEROSENE
DIESEL OILS
CUTTING OILS and SPECIALTIES
many other petroleum products

Gain olfactory relief with an ALAMASK.

Write, wire or phone for specific information. Our Engineering Section provides complete technical guidance.

Rhodia INC.
230 Park Avenue, New York 17, N. Y.
PLANT: PATERSON, N. J.

What's New!

Fluorocarbon Elastomer

. . . information on properties, compounding, vulcanization and fabrication of "KEL-F": 28-page technical release, *Background Information on Kellogg's "KEL-F" Fluorocarbon Elastomer*, describes for the first time this material which will be commercially available early in 1955. The M. W. Kellogg Co., 500 Fifth Ave., New York 36, N. Y.

Circle No. **33** *on Reply Card*

Steam Condensers

. . . for boiler and power plants: 23-page booklet has 7-page section of formulae and tables for engineering design, a discussion of air removal equipment, maintenance, specialties and testing. Condenser Service & Engineering Co., Inc., Observer Highway, Hoboken, N. J.

Circle No. **34** *on Reply Card*

Air and Gas Compressors

. . . claimed to require low horsepower and to be simple to maintain: *Bulletin 601* discusses the "Class ATH" horizontal, double-acting, heavy-duty, water-cooled compressors, showing design principles and sizes, capacities, and ratings. Pennsylvania Pump & Compressor Co., Easton, Pa.

Circle No. **35** *on Reply Card*

Chemically Nickel-Plated Steel

. . . for corrosion resistance equalling that of pure or wrought nickel: *PRD 11-54 P-10* describes "Alcoplate" process developed from the Kanigen process, and gives technical data on porosity, adhesion, hardness, soldering, chemical analysis, chemical resistance, polishing, uniformity, welding, masking, and design considerations. American Locomotive Co., Schenectady 5, N. Y.

Circle No. **36** *on Reply Card*

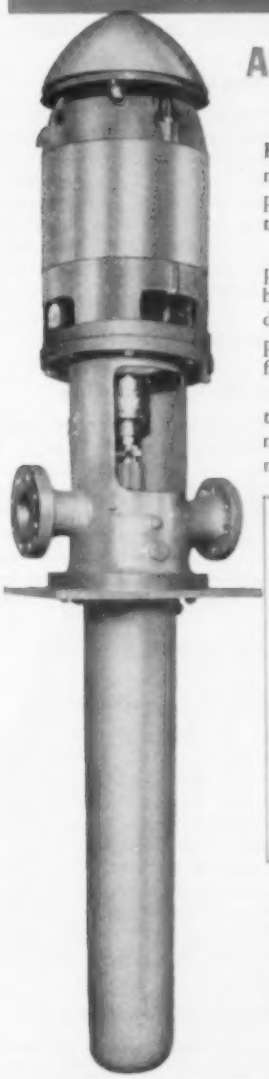
Industrial Meters for Liquids

. . . in the petrochemical, chemical, industrial, processing and other fields: 12-page *Bulletin O.G. 406-R1* discusses the "Rotocycle" stainless steel meters for corrosive liquids with principles of operation, construction features, accessories, dimensions, specifications and applications in quantity control. Meter and Valve Div., Rockwell Manufacturing Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Circle No. **37** *on Reply Card*

(To obtain more data on advertised products see page 564)

NEW! Bingham VCP VERTICAL PUMP FOR LOW NPSH



ALL WORKING PARTS ACCESSIBLE WITH BOTTOM DISMANTLING

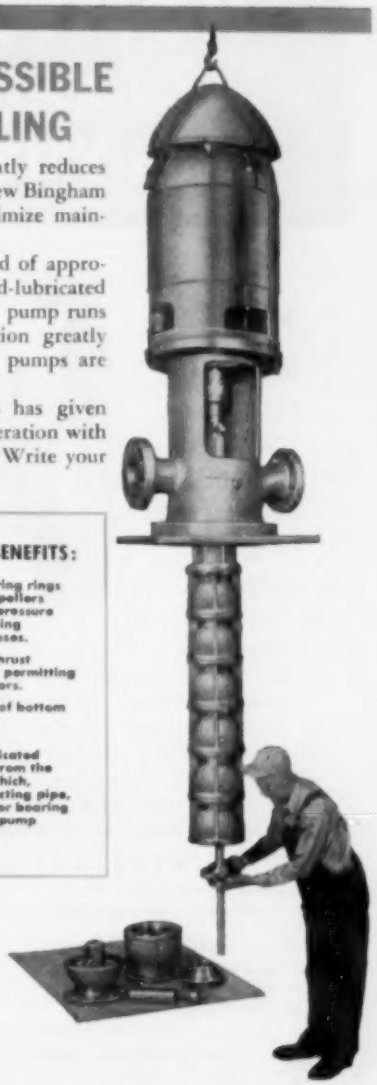
Besides bottom dismantling, which in itself greatly reduces maintenance time when attention is required, this new Bingham pump incorporates advanced features which minimize maintenance, reducing need for periodic inspection.

For example, all intermediate bearings (supplied of appropriate material for different pumpages) are forced-lubricated by pumpage. Bottom bearing is lubricated, even if pump runs dry for short periods. This *dependable* lubrication greatly prolongs life of bearings, which in conventional pumps are frequently the cause of maintenance shutdowns.

Wherever installed, the Bingham VCP Pump has given trouble-free service—plus unsurpassed smooth operation with no vibration. Available for any capacity or head. Write your nearest Bingham office for additional information.

ONLY Bingham OFFERS ALL THESE BENEFITS:

1. Heavy-duty steel suction and discharge head rigidly built to eliminate vibration caused by drivers.
2. Shaft is maximum diameter throughout.
3. Shafts are equipped with renewable 11-13 chrome, hardened, ground and polished sleeves at each bearing.
4. Bearings are of the appropriate material for the different pumpages.
5. Maximum head per stage and maximum efficiency for a given capacity range.
6. Front and back wearing rings on enclosed type impellers permit a one-stage pressure drop over each bearing for lubrication purposes.
7. Wear rings reduce thrust of rotating element, permitting use of standard motors.
8. Maximum eye area of bottom impeller for lowest possible NPSH.
9. Bottom bearing lubricated by pumpage taken from the discharge column, which, together with connecting pipe, acts as a reservoir for bearing lubrication in event pump operates "dry" for short periods.



All working parts of pump easily accessible with bottom dismantling. One man can service after lifting pump from well. By dismantling from bottom, repair or replacement of any part can be made in much less time than with conventional pumps (where dismantling begins from top, necessitating removal of driver and head before pump unit is accessible).

Various operators estimate that time required to reach working parts has been reduced as much as 50%.

Bingham PUMPS SINCE 1921

DOUBLE VOLUTE RADIAL BALANCE

BINGHAM PUMP COMPANY

General Offices: **2800 N.W. Front Avenue, Portland 10, Oregon**

Factories: **Portland, Ore. • Vancouver, B.C., Canada**

SALES AND SERVICE OFFICES

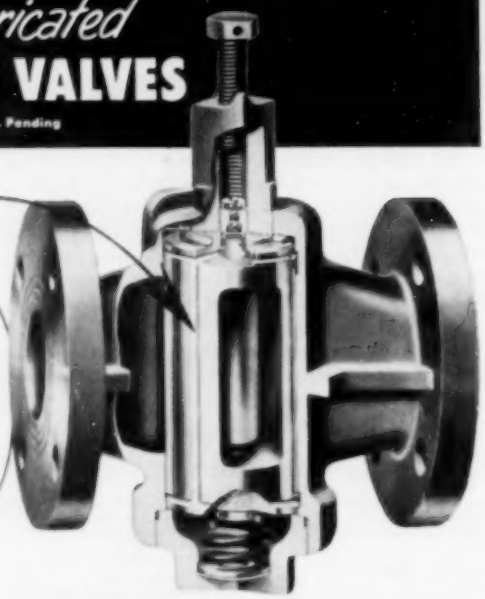
BOSTON, MASS.	PITTSBURGH, PA.
CHICAGO, ILL.	SAN FRANCISCO, CALIF.
DENVER, COLO.	SEATTLE, WASH.
HOUSTON, TEXAS	ST. LOUIS, MO.
KANSAS CITY, MO.	ST. PAUL, MINN.
NEW ORLEANS, LA.	TULSA, OKLA.
NEW YORK CITY, N.Y.	TORONTO, ONT., CAN.
PHILADELPHIA, PA.	VANCOUVER, B.C., CAN.

(To obtain more data on advertised products see page 564)

No. 2* of . . .

12 REASONS WHY
YOU SHOULD BUY AND USE
LOW-PRICED

HOMESTEAD
Lubricated
PLUG VALVES
Pat. Pending



* HOMESTEAD'S EXCLUSIVE, COMPLETELY CONTROLLED HIGH-PRESSURE LUBRICANT SYSTEM

. . . forces chemical seal over all seating surfaces; prevents any possibility of sticking by momentary piston-like action of plug which is moved downward and returned instantly against packing ring. Provides 100% seal around ports; guarantees a completely filled system.

This is only **ONE REASON WHY** you should buy and use, *low priced* **HOMESTEAD LUBRICATED PLUG VALVES.**

HERE ARE ALL TWELVE

1. Reinforced Teflon packing ring.
2. Completely controlled high-pressure lubricant system.
3. 100% pipe area and venturi patterns.
4. No spring torsional stress.
5. No mechanical adjustments.
6. Two lubricants handle most services.
7. Extremely close tolerance between sealing surfaces.
8. Triple head-seal with Lubricant and Teflon packing ring.
9. Plug floated on Teflon surfaces.
10. Leak-proof, double-ball-and-lubricant-sealed check valve.
11. Full-threaded screw assures clean lubricant.
12. Extruded lubricant shows a full protecting system.

FOR CATALOG AND COMPLETE DETAILS MAIL COUPON TODAY

Without obligation, send Reference Book 39—Section 5 on HOMESTEAD LUBRICATED PLUG VALVES.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

HOMESTEAD VALVE MANUFACTURING COMPANY

Serving Since 1892

P. O. BOX 43 CORAOPOLIS, PA.

What's New!

Armored Electric Motors

. . . for use in the oil, construction, and other industries: bulletin *GEA-4654C* provides information on performance and maintenance of heavy-duty electric motors, horsepower ratings, mechanical data, diagrams, and applications. General Electric Co., Schenectady 5, N. Y.

Circle No. **38** *on Reply Card*

Rigid Polyvinylchloride

. . . nonplasticized for use in the petroleum, petrochemical, chemical, and other industries in corrosive service: data sheets give physical properties and the chemical resistance of the plastic for more than 280 chemicals. Stokes Molded Products Div., The Electric Storage Battery Co., Taylor and Webster Sts., Trenton 4, N. J.

Circle No. **39** *on Reply Card*

Centrifugal Pump Design

. . . for horizontal and vertical, single and multi-stage types: 32-page *A Technical Treatise on the Advancement of Centrifugal Pump Design* discusses "Single Volute" and "Double Volute" pumps with respect to construction, performance charts and photographs of actual units and installations. Bingham Pump Co., Portland, Ore.

Circle No. **40** *on Reply Card*

Recording Spectrophotometer

. . . for expediting product control analyses and claimed to be the fastest commercially available: 20-page bulletin on *The Warren Spectracord* includes circuit diagrams, a step-by-step explanation of the electronic recording and control systems with current prices, catalog numbers and details of useful accessories. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.

Circle No. **41** *on Reply Card*

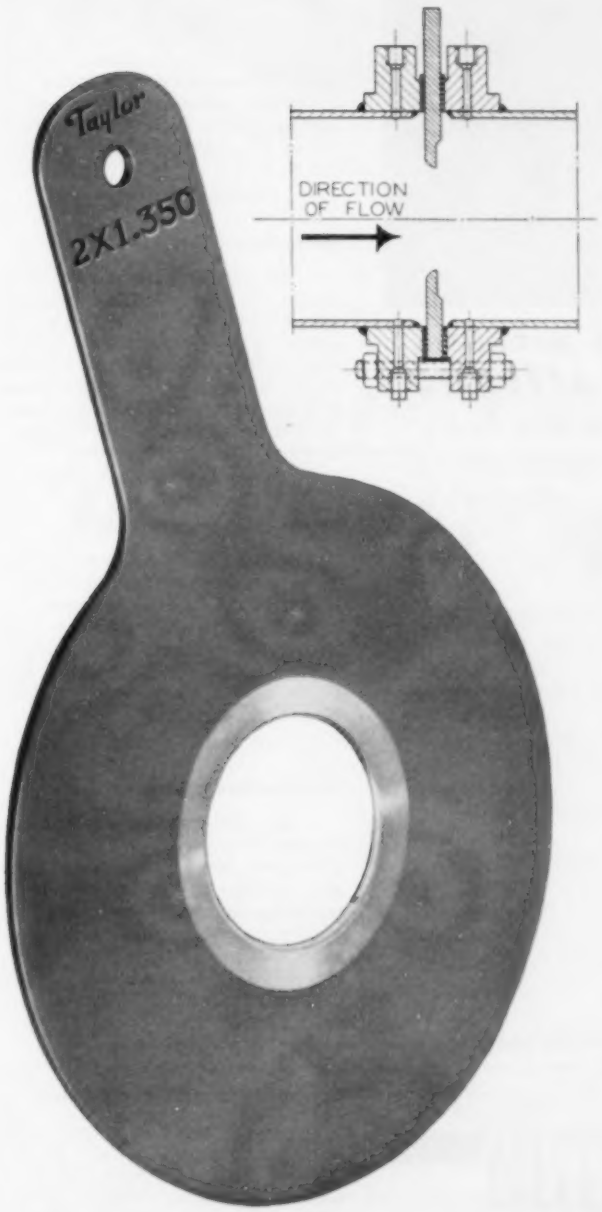
Oil Industry Explanations

. . . for individuals, schools or other groups explaining the complex operation of the oil industry in clear, simple language: 32-page *The Story of Petroleum* tells how exploration crews hunt oil, how drilling crews sink wells, how pipelines move oil to refineries, how chemists and engineers refine crude oil, and how the people in distribution operate, etc. Shell Oil Co., 50 W. 50th St., New York 20, N. Y.

Circle No. **42** *on Reply Card*

New improved measurement of

LOW FLOWS WITH VARYING VISCOSITY



AS A RESULT OF TAYLOR'S BROAD EXPERIENCE WITH QUADRANT EDGED ORIFICE

THE Quadrant Edged Orifice is the result of considerable effort to find a primary element suitable for low Reynolds number flow measurement. This type of flow is encountered when viscosity is a factor both in magnitude and variation. The orifice edge has a rounded approach on its upstream face making it practically insensitive to viscosity changes so long as the throat Reynolds number does not exceed 250,000. For all practical purposes it has a constant coefficient over the Reynolds number range of 5000 to 250,000. Calibration curves are therefore unnecessary—standard square root charts can be used even on low flows. This constant coefficient characteristic permits the use of an integrator in the recorder or a planimeter with the charts.

Our experience has shown that unusual machining skills are required to produce this type of orifice satisfactorily—the edge contour being extremely important. If you have flow measurement problems that could benefit from the use of this Quadrant Edged Orifice, we suggest you submit them to Taylor for analysis and recommendation. Meantime write for technical bulletin to Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

• • •

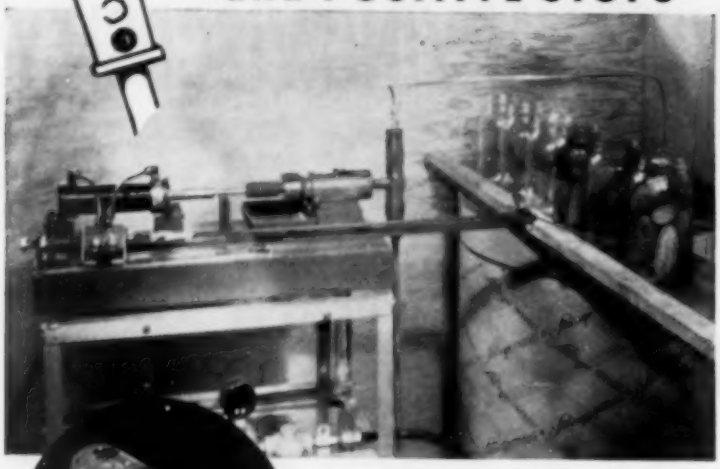
Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Taylor Instruments MEAN ACCURACY FIRST

 (To obtain more data on advertised products see page 564)

Here's how to get

QUICK STARTS and POSITIVE STOPS



New HILLS-McCANNA *AIR ACTUATED* Metering and Proportioning Pumps

Have *you* a problem involving continuous metering of small volume flows? The new Hills-McCanna air actuated pumps can solve these problems in many cases where conventional pumps are not satisfactory . . . because they have an air cylinder drive. With them you can start fast and accurately and stop immediately — at high or low speeds.

In the photo above a "UP" type pump is used as a "pickle pump" — adding just the right amount of brine to pickle jars. Other uses range from the injection of petroleum additives to putting ink in fountain pens. In all these services, the "UP" is dependable and accurate and may be used with a wide variety of controls.

Hills-McCanna air actuated pumps are available in capacities of 0.1 gph. to 200 gph., with adjustable stroke lengths for positive volume control . . . all are built to the same high engineering standards as Hills-McCanna electrically driven pumps.

Write for Bulletin UP-55 — HILLS-McCANNA CO., 2399 W. Nelson St., Chicago 18, Illinois.

DESIGN DETAILS

- External, interchangeable check valves
- Interchangeable barrel and housing
- Unitized construction, common base
- Positive stroke adjustment
- Trouble-free operation

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of:
SAUNDERS TYPE DIAPHRAGM VALVES
FORCE FEED LUBRICATORS • MAGNESIUM SAND ALLOY CASTINGS

What's New!

Advantages of Alloy Steels

. . . due to improved weight-to-strength ratios and resulting economic advantages: 200-page *Alloy Steel Pay Off* covers economic and production figures for different steels, cost comparisons for various process equipment, operating economies, fabrication costs, physical life, and 60 detailed case histories covering many industries. Copies available to technical, administrative, purchasing and equipment maintenance personnel by writing directly to the Climax Molybdenum Co., 500 Fifth Ave., New York 36, N. Y.

Do Not Use Reply Card

Recording Charts

. . . for standard and special instruments: 12-page catalog includes samples of both dial and roll type charts, describes the method of production of over 8000 different standard charts, and gives technical information on requirements for special charts. Technical Charts, Inc., 189 Van Rensselaer St., Buffalo 10, N. Y.

Circle No. **43** *on Reply Card*

First Philippines Refinery

. . . at Batangas: *First in the Philippines* gives descriptions and photographs of the facilities for crude distillation, catalytic cracking, gas recovery, catalytic polymerization, etc., built for Caltex (Philippines) Inc. Foster Wheeler Corp., 165 Broadway, New York, N. Y.

Circle No. **44** *on Reply Card*

Glycol-Ether Solvents

. . . for petrochemical applications: 40-page *Cellosolve and Carbitol Solvents* gives detailed description of the nine commercial glycol-ethers sold by this company with specifications, laboratory control tests, physical properties, shipping data, bibliography, etc. Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.

Circle No. **45** *on Reply Card*

Copper & Copper-Alloy Specs

. . . for the more commonly used alloys: 24-page *Publication B-34R*, "Copper and Copper-Alloy Specifications Index" includes ASTM, ASME, AWS, SAE, AMS, Federal, Military, Army, Navy, and Joint Army-Navy specifications. The American Brass Co., Waterbury 20, Conn.

Circle No. **46** *on Reply Card*

Look into "United" lead-lined products

to keep corrosion in line . . . get them from National Lead Company

Under the trade name "United," National Lead Company manufactures lead-lined pipe in two categories . . . "United Tubond" and "United" expanded. Both combine the corrosion resistance of lead with the strength of steel.

"United Tubond" pipe is used where acid handling is difficult, where the lines are subject to external abuse, vibration, high internal pressure, elevated temperature or vacuum. In "Tubond" pipe the bond between lead lining and steel pipe is virtually inseparable.

"United" expanded lead pipe, generally used for handling acids under "average" conditions, is produced by inserting a lead pipe in a steel pipe and expanding the lead lining under heavy pressure.

Whether you buy "United Tubond" or expanded, you may be sure you are getting a product with the grade of lead, thickness of lining, and method of joining calculated to give you your money's worth in strength and corrosion resistance.

Under the "United" brand you can also get the other components of a corrosion-resistant acid handling system — valves, fittings and pumps.

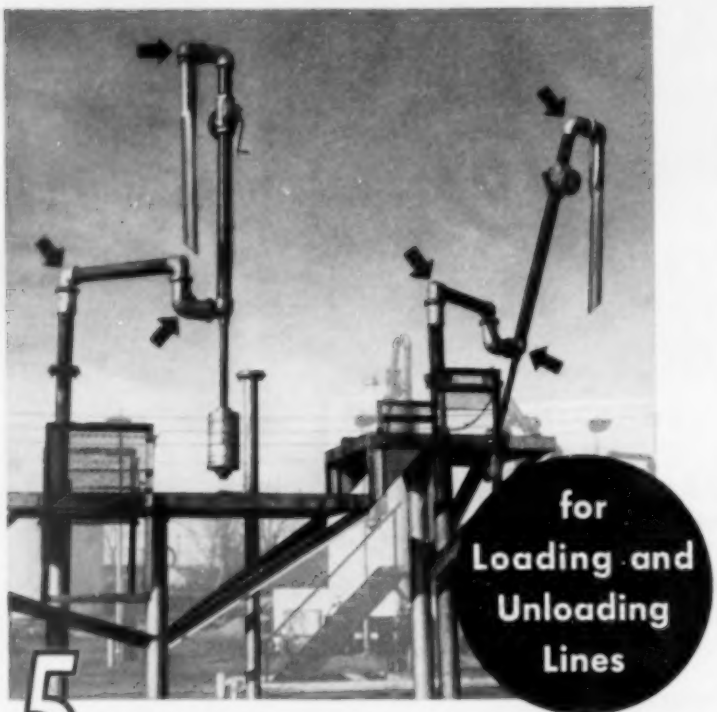
So put your corrosion control problem up to National Lead. Take advantage of our experience in working out chemical process applications of lead equipment.

NATIONAL LEAD COMPANY

New York 6 • Atlanta • Baltimore 3 • Buffalo 3 • Chicago 80 • Cincinnati 3 • Cleveland 13 • Dallas 2 • Philadelphia 25 • Pittsburgh 12 • St. Louis 1 • Boston 6 (National Lead Co. of Mass.) • Los Angeles 23 (Morris P. Kirk & Son, Inc.) • Toronto, Canada (Canada Metal Company, Limited).

 (To obtain more data on advertised products see page 564)

BARCO Swing Joints and Assemblies



5 Reasons for SUPERIORITY!

1. **BALL BEARING AND O-RING EQUIPPED**—Designed specifically for handling gasoline, oil, lube oil, LP gas, petro-chemicals, and other petroleum products.
2. **LARGE BEARING SURFACE**—Barco's bearing design provides adequate support for lengths of piping. Minimizes bearing pressures and wear.
3. **CONTROLLED TORQUE**—No annoying, uncontrolled swinging of lines. They swing easily but stay put.
4. **LONG LIFE**—New "Bar-Moly" dry lubricant process gives a permanent anti-galling, corrosive-resistant finish to moving parts. This, combined with routine lubrication, insures longest possible maintenance-free service.
5. **EASY MAINTENANCE**—Joints can be disassembled for inspection without disconnecting piping. O-rings are easily renewable in the field. Frequent greasing not required to maintain sealing.

The Barco line is complete with single swing, double swing, and counter-balance styles and assemblies to meet every need. Sizes 1", 1¼", 2", 2½", 3", 4". All steel or malleable iron. Send for latest Catalog No. 400 containing engineering and ordering information. *Worldwide sales and service.*

BARCO MANUFACTURING CO.
559E HOUGH STREET
Barrington, Illinois

What's New!

Induced Draft Cooling Towers

. . . for refinery, natural gas and other installations: 30-page *Bulletin 4.9.080* describes materials of construction, structural features, mechanical equipment, typical installations, sizes available, important factors in selecting cooling towers, and how to evaluate bids. J. F. Pritchard & Co. of Calif., 4625 Roanoke Parkway, Kansas City 12, Mo.

Circle No. **47** *on Reply Card*

Organic Chemical Index

. . . for over 100 compounds including acetylenic alcohols, fused ring heterocyclics, hydrocarbons, phenol and substituted phenols, and pyridine and pyridine derivatives: *Reilly Chemical Index, 2nd Edition* lists purity specifications and illustrated formulae. Reilly Tar & Chemical Corp., 1615 Merchants Bank Building, Indianapolis 4, Ind.

Circle No. **48** *on Reply Card*

Titration by Instrumentation

. . . of the potentiometric, conductometric, and amperometric types: *Bulletin FS-247* explains each type of titration and its instrumentation in detail. Fisher Scientific, 717 Forbes St., Pittsburgh 19, Pa.

Circle No. **49** *on Reply Card*

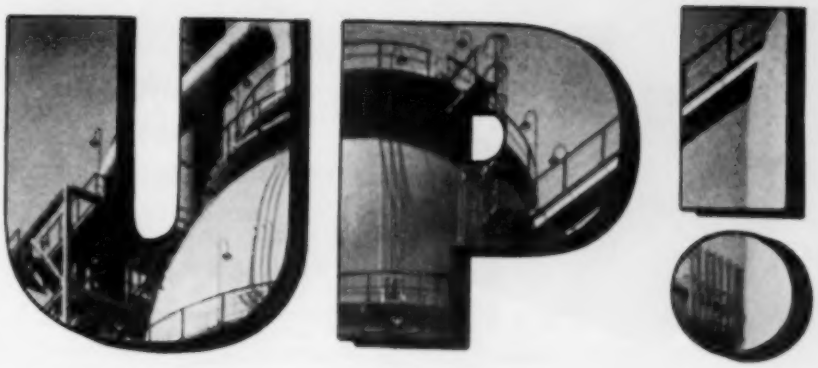
Did You Miss These?

The following items, reviewed originally in January, have aroused considerable interest among the readers. They are repeated briefly as a service to those who might have missed them the first time they appeared. For details or literature, please use the regular Reply Card in this issue.

Plant Scale Models Are Made Quickly by "Erector Set" Kit

. . . from which a series of photographs can be obtained giving the equivalent of design engineer's or draftsman's construction plans. The "PDQ" kit includes plastic and wood models accurately scaled to drawing size, especially suited for the chemical and petrochemical industries. Model construction can be accomplished directly by the engineer from his flow sheet or plot plan. It is claimed that this method requires but a fraction of the time and cost required for conventional methods, eliminates the need for model makers, and allows more secrecy for the using company. The

HOW TO KEEP PRODUCTION UP!



A few generations ago, John Ruskin had a few penetrating remarks to register on business—and what he said makes a lot of sense today.

"The common law of business practice," he commented, "prohibits paying a little and getting a lot. If you deal with the lowest bidder, it's well to add something for the risk you run. And if you do that, you will have enough left over for something better."

Let's translate this in terms of furnace construction for refineries. If you buy a heat enclosure for a job where high and continuous production is a must, then it's imperative that you invest in one that will stand the gaff. To make sure, you've got to build a unit which is properly engineered for the job it must do. You pay more, of course. But it's poor economy—and often embarrassing—to plow money back into repairs right at the peak of production.

That's all we have to say. You get sound engineering and a job designed to stay on stream when you come to Bigelow-Liptak. We've been designing refinery furnaces for years—erecting them, too. Both suspended and castable construction—the one that's best for the job—are used. Better investigate—right now!

FIRST COST OF AN INFERIOR JOB

PLUS REPAIRS AND LOST PRODUCTION

FIRST COST OF A BIGELOW-LIPTAK JOB

BIGELOW-LIPTAK Corporation

AND BIGELOW-LIPTAK EXPORT CORPORATION
2550 WEST GRAND BOULEVARD, DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

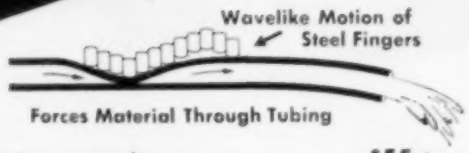
In Canada: BIGELOW-LIPTAK OF CANADA, LTD., *Toronto, Ontario*

ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK
PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SAULT STE. MARIE, MICH. • SEATTLE • TULSA • VANCOUVER, B.C.

(To obtain more data on advertised products see page 564)

PUMP Liquids • Gases • Slurries

WITHOUT CORROSION OR CONTAMINATION



Prices range from $55 to $500 depending on size of pump and accessory equipment required.

Write for Catalog

SIGMAMOTOR Inc.

25 NORTH MAIN STREET MIDDLEPORT, N. Y.

Your 1954 Editorial Index Is Ready

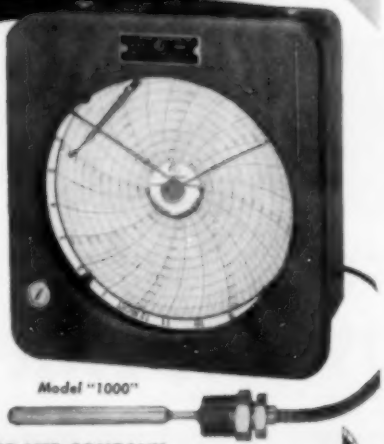
It lists by subjects all the feature articles and major department items published in *Petroleum Processing* last year. A separate section lists all authors and the titles of their articles. You can have a copy simply by circling No. 79 on the Reader's Service card between pages 564 and 565. Fill in your name and address, drop the card in the mail, and we'll do the rest.

AUTO-LITE

TEMPERATURE RECORDING...

Newly designed, Model "1000" Auto-Lite Recorder gives permanent proof of temperature behavior. • 6" clear reading chart; various standard ranges from minus 40°F. to plus 550°F. • 3 standard types; choice of 24-hr. or 7-day cycle. • Electric or mechanical chart drive. • With capillary tubing for remote reading. Priced from $49.50.

Send for new catalog describing many styles of Auto-Lite temperature Recorders and Indicators.



Model "1000"

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE RECORDERS

What's New!

Parco Co., Inc., 82 Beaver St., New York 5, N. Y.

Circle No. **50** *on Reply Card*

Organic Chemicals Properties

. . . on more than 350 synthetic organic chemicals: booklet *F-6136* gives gravities, vapor pressures, solubilities in water, and boiling, freezing, and open cup flash points. Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.

Circle No. **51** *on Reply Card*

Oil-Water Separation

. . . for refinery waste water: *Technical Reprint T-124* discusses methods of treating waters containing oil, and the de-oiling of refinery waste water for reuse. Graver Water Conditioning Co., 216 W. 14th St., New York 11, N. Y.

Circle No. **52** *on Reply Card*

Air Pollution Report

. . . presents basic conceptions which underlie research work: *Current Conceptions on Air Pollution* discusses classifications, measurements, weather effects, historical records, and hydrogen sulfide incidence. Industrial Hygiene Foundation of America, Inc., 4400 Fifth Ave., Pittsburgh 13, Pa.

Circle No. **53** *on Reply Card*

Refractory Concrete Manual

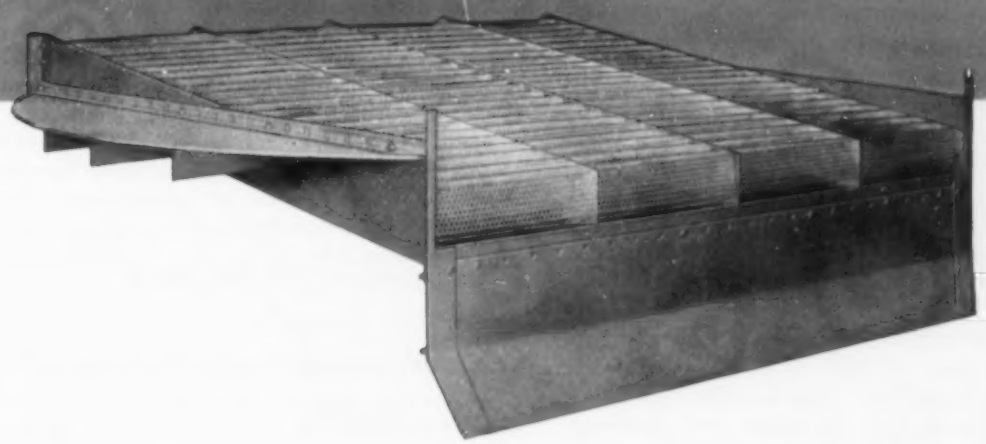
. . . for calcium-aluminate cement, "Lumnite," used as binder for refractory and insulating aggregates: *Refractory Concrete Manual* describes mix proportions and aggregate, making refractory cement from preparation through cure, insulating values, structural design, reinforcing, and industrial applications. Universal Atlas Cement Co., Lumnite Div., 100 Park Ave., New York 17, N. Y.

Circle No. **54** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of Petroleum Processing to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item. Then fill in the rest of the card and drop it in the mail. No postage is required.

"Extraordinary Performance Is Routine" with KASKADES



CASE HISTORY No. 1...

One refiner was operating a 7.5' vacuum tower which was limiting capacity and yields due to the pressure drop of existing bubble trays. Capacity desired was:

Vapor....24,600 #/hr of 0.0137 #/cf density
Liquid.....36,400 #/hr of 58.3 #/cf density

This refiner replaced the bubble trays with "Benturi" Kaskade trays on the same supports, and is now obtaining a pressure drop of less than 1.0 mm hg pressure drop per tray.

CASE HISTORY No. 2...

An engineering firm recognized a pressure drop problem with a process duty equivalent to:

Vapor.....35,500 #/hr of 0.26 #/cf density
Liquid.....965,000 #/hr of 62.4 #/cf density

Yet, multi-pass "Benturi" Kaskade trays in a 7.5' diameter column gave them less than 2.0 mm pressure drop per tray.

Whether your problem is extraordinary or routine, the design flexibility "Benturi" Kaskade tray is probably your answer to greater capacities and higher efficiencies. Wire, write or phone us on its application to your fractionating problem, there's no obligation.

KOCH ENGINEERING COMPANY, INC.

DESIGNERS • MANUFACTURERS • BUILDERS
321 WEST DOUGLAS • WICHITA 2, KANSAS

Tulsa, Oklahoma, Repr.
W. C. Myers Co.
Wright Building

Houston, Texas, Repr.
Alpha Engineering Company
P. O. Box 12371

Eastern Repr.
Crawford Engineering Company
295 Madison, New York, N. Y.

Pittsburgh, Pennsylvania, Repr.
D. D. Foster Company
501 Alcoa Building

FINANCIAL AID TO HIGHER EDUCATION

Our Colleges and Universities Are Living on Borrowed Time

. . . time borrowed from underpaid faculty members

The chart on this page tells a story of profound importance to every American. It is the story of the financial beating our college and university faculty members have been taking in the past 14 war and postwar years.

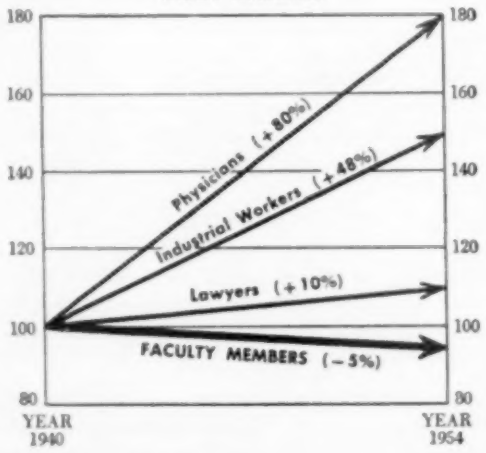
On the whole, this span of 14 years has been one of great and growing prosperity. But, as the chart shows, our college and university faculty members have, as a group, had less than no share in it.

During this period, from 1940 through 1954, the real income of the average industrial worker (that is, what his wages would purchase in goods and services) has increased by almost one-half. Among professional groups, physicians have enjoyed an increase of about 80 per cent in their real income. Lawyers, far less favored financially, have had an increase of about 10 per cent. But faculty members have not only had no increase at all; over these years of prosperity their average real income has fallen by 5 per cent. These figures do not take account of the increase in taxes since 1940.

Senior Teachers Hardest Hit

These figures are, of course, averages. For some groups of faculty members it has been better; for others worse. It has been particularly hard on senior faculty members. Between 1941 and 1953 their salaries lost about 8 per cent of their purchasing power. Being deeply committed to their careers they could not respond to alternative employment opportunities as readily as could their junior colleagues. For junior faculty members there was some increase in real income between 1941 and 1953 but only about half as much as the average for the nation.

What's Happened to College Faculty Salaries*



* Real Income before Taxes.

Source: Council for Financial Aid to Education; U. S. Dep't of Commerce; U. S. Dep't of Labor

Public Colleges Fare Better

There are also marked differences in the average financial reward received by faculty members in different types of colleges and universities. A recent study by the Council for Financial Aid to Education indicates that, in the last academic year, 1953-1954, teachers in privately endowed, independent colleges and universities were paid an average salary about $1000 less than that paid to faculty members in tax-supported institutions. The same study indicates that salaries far below the average are especially common for faculty members in the small private liberal arts colleges. This study found that during the last academic year the average salary of all college and university faculty members was about $4700.

The special difficulties under which the independent colleges and universities, and particularly the independent liberal arts colleges, are laboring to get back on their feet financially have been discussed in previous editorials in this series. These difficulties underline the need of special help for these institutions to which business firms are now contributing in increasing volume. However, the problem of providing better salaries is not peculiar to any particular type of institution.

Faculty Members Not Greedy

It is not easy to prescribe a precise standard of fair pay for college and university faculty members. This is partly because they put less weight relatively on money rewards than they put on rewards of scholarly accomplishment and prestige. Consequently, they have consistently been willing to work for very modest salaries in relation to the intellectual ability, education and application required. Obviously, however, it is the dictate both of fairness and good judgment to see that faculty members are given a roughly proportionate share in the general prosperity. Indeed, their crucial role in our society could be made to justify a larger share than this.

There is no way to know with any degree of precision what the underpayment of our college and university faculty members over the past 14 years has actually cost the nation in terms of reduced quality of intellectual performance of those institutions. One reason is that the damage has been minimized by the devoted services of many faculty members who have loyally stuck to their jobs in spite of the great financial discouragement.

It is obvious, however, that, if no grave deterioration in the intellectual performance of our colleges and universities has occurred so far, it is because we have been living on borrowed time. It is time borrowed from faculty members who have, in effect, been subsidizing these institutions by their financial sacrifice. This arrangement is not only a menace to the cultural and intellectual life of the nation, it is also a menace to our national security in a time when successful national survival may well depend in peculiar degree on the full development and utilization of our intellectual resources. We depend on our college and university faculties pre-eminently to provide this development. Adequate financial reward for such service is an elementary form of national insurance.

Many of our colleges and universities are working hard to improve the financial lot of their faculty members. Business firms are also playing an increasing role of providing the necessary financial assistance. The methods being used by business for this purpose will be the subject of another editorial in this series. However, **vastly more must be done, and quickly, to stop the financial beating being taken by our college and university faculty members if the nation's welfare and safety are to be properly protected.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

EDITORIALS . . .

There's Danger in Curbing Imports by Law

Backed by 40 years' experience in reporting oil news, the writer of the following editorial points out that periods of surplus crude production, or of capecity to produce, are not new. He emphasizes the importance of the oil companies adjusting their own operations to meet the present conditions, rather than calling for restrictions of imports by law, which may later greatly handicap their operations.—The Editor.

THE economic problems that disturb producers and refiners today and threaten federal regulation of petroleum imports stem from a surplus of capacity to produce crude oil. This situation is not new in the history of petroleum, but it is new in the experience of many oil company executives. The novel aspect today is that the surplus capacity is in foreign producing fields, as well as in many U.S. producing areas.

Up to about 20 years ago refiners accepted as normal operations temporary periods of surplus crude supply. These were followed by periods when it appeared that large volumes of new production would be needed. These "shortages" in turn stimulated drilling and brought in new production, completing the cycle. The last surplus of great magnitude came in the '30s when the Oklahoma City, East Texas and other new pools were in their prime.

From this experience the oil companies, in cooperation with the conservation agencies in Texas and some other states, and sanctioned by the federal government, developed today's system of setting up allowable rates of production. These allowables are determined by the oil companies' own estimates of their current market demand needs, and the system is based on the right of the state to conserve its petroleum and gas resources.

This cooperation of oil companies and state agencies has worked successfully in preventing wide surplus production and the resulting waste. But the initiative of determining the volumes of crude needed has been left in the hands of the oil companies.

Shifting to the current scene, during recent years the oil companies, to help build our national defense bulwarks, set out to increase crude oil productive capacity in the U. S. Today this idle producing capacity is some 2,000,000 b/d more than the needs for refining, for export, and for other lesser demands.

In addition and with encouragement by the government, the oil companies moved to develop their foreign oil holdings. Since the war they have invested nearly four billion dollars in foreign countries—both to give this country production abroad which it might need in the event of war, and to help improve economic conditions in these nations and aid in holding them in the camp of the free world.

Until six years ago, five oil companies imported crude into the U. S., mostly their own production. Today, some 18 U. S. oil companies are bringing in foreign crude—a good part of it oil purchased abroad. In 1954 total imports of crude were a little above 10% of our domestic production.

Thus, the industry today is confronted not with a surplus of actual domestic production but a surplus of productive capacity, aggravated by increasing imports of foreign oil. As in past periods of surplus production, some elements in the industry, this time mainly Texas producers, seek relief through legislation. Already introduced in Congress is a proposal to restrict imports of petroleum, including residual fuels, for any quarter of the calendar year to 10% of domestic demand in the same quarter of the previous year.

Several factors complicate the picture. One is the well organized campaign of the coal interests to force import restrictions, in the hope of regaining some of the markets they have lost to petroleum. Another is the competition of natural gas, which in recent years has taken some markets from both coal and petroleum, and has thus added to the present surplus. Still another factor exists in the form of excess refinery capacity; as part of their contribution to national defense, U. S. refiners are maintaining 1,000,000 bbls. or more of standby capacity, which provides a strong incentive for some companies to run more crude than their markets require.

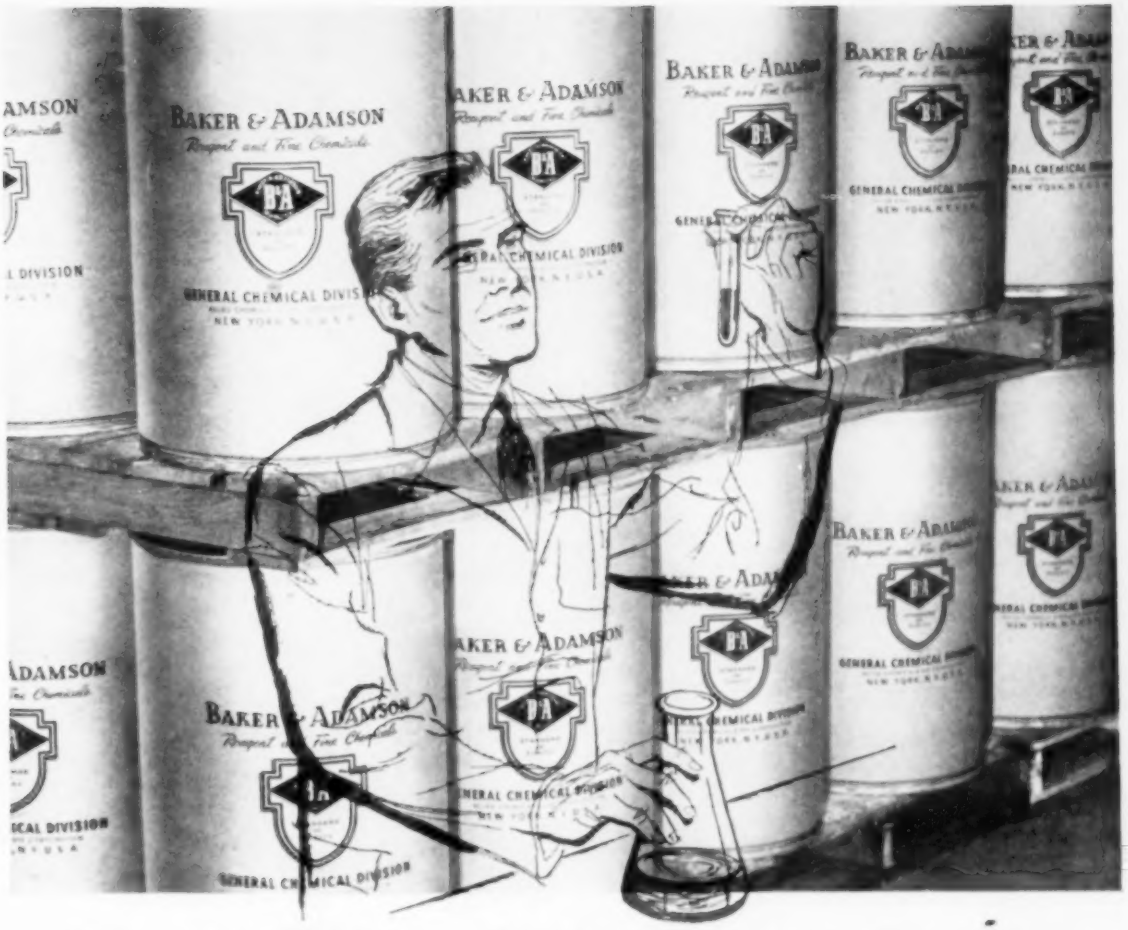
The fundamental problem, however, is still one of another period of surplus crude, although in this instance it is one of surplus productive capacity rather than surplus output. As with past periods of surplus, this one will be short, in terms of the years of the industry, as markets expand both in this country and abroad.

To solve the problem, the oil companies face two alternatives. They can have permanent restrictive legislation on imports, or they can themselves limit their own imports in accord with some such flexible formula as is proposed by the President's Cabinet Fuels Policy Committee. This committee recommended that imports of crude and heavy fuel oil be held to the "restrictive proportions that these imports bore to the production of domestic crude in 1954."

The latter method is the sound approach, although it is recognized that it will be difficult for some individual companies to comply with the formula. Self-imposed restrictions of imports will give the domestic producers some relief in this period of surplus.

More important than that, however, it will leave the oil companies here with the freedom of initiative and flexibility in operations which has carried them through crises in the past. It will leave them best fitted to meet what the future may hold.

—V. B. Guthrie



B&A Special Chemicals

your keys to volume production!

Going into volume production with new research developments means a call for special chemicals "tailor-made" to rigid specifications. Two things are required of such chemicals—their quality must be unvarying . . . and their supply must be dependable. Providing the process industries with this "quality in quantity" has been the special province of Baker & Adamson for more than 76 years.

If your process calls for special chemicals, avail yourself of B&A's extremely versatile manufacturing equipment and production experience. An early, confidential discussion of your needs with a member of B&A's technical sales staff will help assure prompt delivery to meet your production schedule!

GC Allied Chemical

REAGENTS B·A STANDARDS OF PURITY FINE CHEMICALS

BAKER & ADAMSON® *Fine Chemicals*

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Offices: Albany* • Atlanta • Baltimore* • Birmingham* • Boston* • Bridgeport* • Buffalo* Charlotte* • Chicago* • Cleveland* • Denver* • Detroit* • Houston* • Jacksonville • Kalamazoo Los Angeles* • Minneapolis • New York* • Philadelphia* • Pittsburgh* • Providence* St. Louis* • San Francisco* • Seattle • Kennewick and Yakima (Wash.)
In Wisconsin: General Chemical Company, Inc., Milwaukee

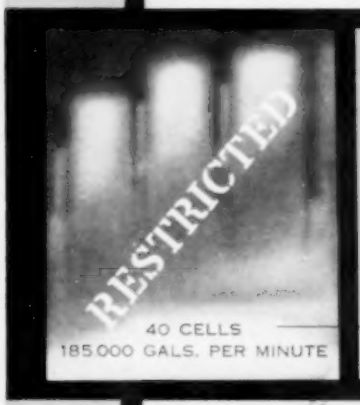
In Canada: The Nichols Chemical Company, Limited • Montreal* • Toronto* • Vancouver*

SETTING THE PACE IN CHEMICAL PURITY SINCE 1882
*Complete stocks carried here

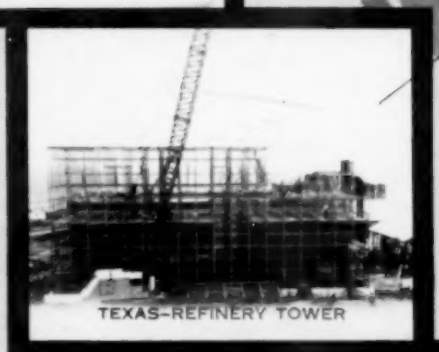
THERE MUST BE A REASON WHY...

CANADA–4-CELL TOWER

CHICAGO–10-STACK TOWER



40 CELLS
185,000 GALS. PER MINUTE



TEXAS–REFINERY TOWER

SIDE PLATE
JOINT CONNECTIONS

THE WIND-TROL

SANTA FE is now among the top manufacturers of cooling towers in the world.

The reason is . . .

ENGINEERING KNOW-HOW AND PRODUCTION ABILITY

In 1954 Santa Fe reached a new high in its 50-year history, designing and installing more cooling facilities in the United States, Canada, and Mexico than ever before completed in a single year. Forward thinking made this progress possible. Outstanding engineering advances developed were:

1. Highest individual fan stacks ever built.
2. Recirculation equalization channels.
3. Side plate joint connectors – bracing system.
4. Control-Flo Tower (cross- and counter-flow.)
5. Dual-Safety Switch to prevent costly tower damage and assure safety to personnel.

AND NOW . . .

6. The Wind-Trol–an economic, efficient counter- or cross-flow forced air tower that nullifies the problem of recirculation.

SANTA FE TANK & TOWER CO., INC. SINCE 1903

"Our best ads are installed."

SANTA FE

TANK & TOWER CO., INC.

5401 South Boyle Avenue
Los Angeles 58, California

BRANCHES IN PRINCIPAL CITIES